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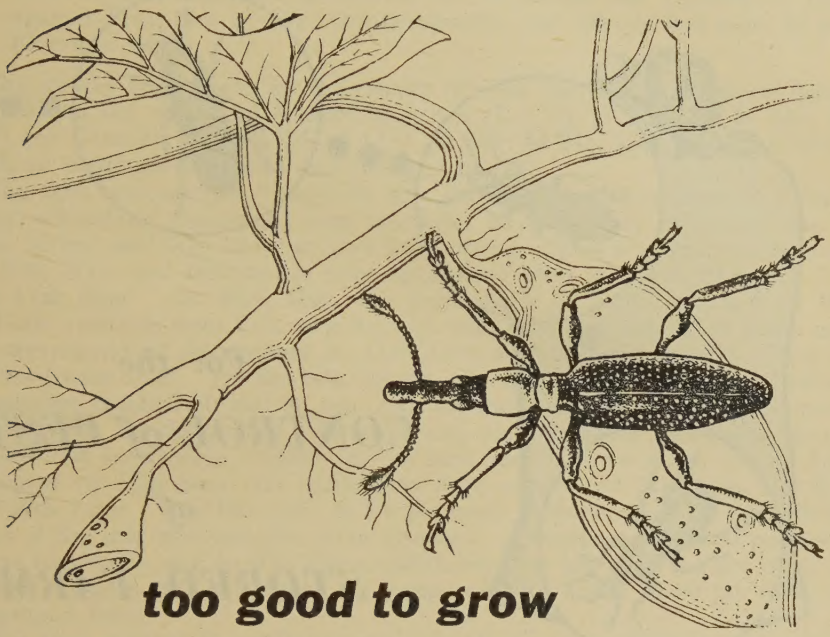

too good to grow

When the Conquistadores came to the New World they gave a new name to a root which had been food for men centuries before Columbus sighted Hispaniola. *Camote*, the Indians called it: *Batata*, it became—the Spanish, or Sweetpotato, grown today in many lands. *If it is worth the growing.*

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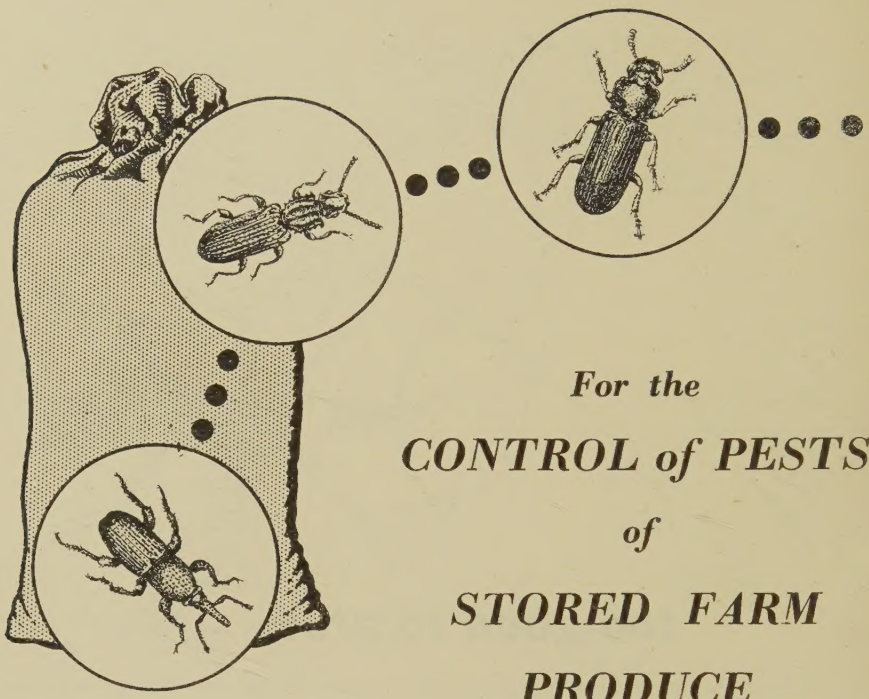

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Zocchi (R.). **Gli insegnamenti della lotta contro i tripaneidi dei fruttiferi in esperienze eseguite in Emilia e Toscana nel 1955.** [The Lessons from Control Experiments carried out in Emilia and Tuscany in 1955 against Fruit-flies.]—*Riv. Ortoflorofruttic. ital.* **40** no. 3–4 repr. 12 pp. Florence, 1956.

The author briefly reviews the results of work carried out in recent years in Italy on the control of *Rhagoletis cerasi* (L.) [*cf. R.A.E.*, A **41** 344; **44** 199] and *Ceratitis capitata* (Wied.) [*cf.* **42** 339; **43** 24], and gives an account of those obtained in Emilia and Tuscany in 1955.

The first test against *Rhagoletis* was carried out with a sweetened bait-spray containing micronised lead arsenate, on previously untreated cherry trees of two mid-late and one very late variety. The first adults appeared on 15th May, and treatments were applied on 18th and 28th May and 7th and 17th June. On 30th May, the percentages of fruits attacked on the mid-late varieties were 2–3, as compared with 60–70 on untreated trees, and the corresponding percentages on 11th June were about 5 and 80. Picking followed soon after. On the late variety, which is of little commercial value, infestation reached 80 and 95 per cent. on the treated and untreated trees, respectively, by 28th June. In a second test with the same bait-spray, carried out in another district on medium and late varieties, adults first appeared on 16th May and treatments were applied on 21st May and 2nd and 12th June. On 15th June, 2–2·5 per cent. of the cherries on the treated trees of the mid-late varieties were attacked, as compared with 50 per cent. for no treatment, and on 30th June, infestation was less than 4–5 per cent. on treated cherries still not picked, as compared with about 70–85 per cent. on unsprayed trees.

The tests against *C. capitata* were carried out on persimmon and peach. In two plots containing mixed varieties of peach, the treatments consisted of the lead-arsenate bait-spray and a spray containing 0·5 per cent. DDT, respectively. Treatments were applied on 19th and 29th July, 10th and 20th August and 3rd September, and trap-glasses of the Spanish type [**35** 151] were also used in the first plot, 62 being hung among some 50 trees. The catches in these showed that the fruit-fly was numerous. The attack began about mid-August, and 68·2–74·1 and 68·4–73·2 per cent. of the ripe fruits in the two plots, respectively, were attacked by 2nd September, as compared with 98·8 per cent. for no treatment. Up to 25 larvae per fruit were found on the untreated trees, but not more than 19 on the treated ones. On 11th September, infestation of ripe fruits had reached 77·2–81·2 and 82·4 per cent. in the two plots, respectively, as compared with 99·4 per cent. for no treatment. At a final examination on 17th September, the corresponding percentages were 66·9, 65·1–68·2 and 67·9–97·1.

In the tests on persimmons, which ripen considerably later than peaches, sprays containing a mixture of 0·5 per cent. DDT and 0·02 per cent. parathion, or 0·075 per cent. malathion and 0·03 per cent. parathion, were applied on 15th and 30th September and 18th October. By 10th November, 5 and 7 per cent., respectively, of the fruits on treated trees were attacked, as compared with 15 per cent. on untreated ones.

di Martino (E.). **L'*Otiorrhynchus cribricollis* Gyll. dannoso agli agrumi della Sicilia orientale.** [*O. cribricollis* injurious to *Citrus* in eastern Sicily.]—*Riv. Agrumic.* **1** fasc. 5–6 pp. 239–251, 6 figs., 18 refs. Acireale, 1956.

Adults of *Otiorhynchus cribricollis* Gylh. have since 1952 caused severe injury to the leaves of *Citrus* in parts of eastern Sicily, and damage had been reported from the Provinces of Catania, Syracuse and Enna by 1955. Sweet

(2506) Wt. P8510/3911 11/57 E.P. Ltd. Gp. 566. [A]

orange and lemon were mainly attacked, and damage was also observed on olive. The adult is briefly described, and the distribution, bionomics and food-plants of the weevil are briefly reviewed from the literature; the larvae are recorded as living in the soil.

In Sicily, *O. cribricollis* has one generation a year. The adults, which feed at night and shelter during the day in the soil beneath the trees at depths of 4–12 ins., appeared in May and fed throughout the summer, disappearing in October, though occasional individuals were observed up to early December. The date when the first signs of damage were observed varied with the locality, probably depending on the availability of other vegetation, and the attack did not begin until August–September in one district in 1955. The weevil has apparently only recently become adapted to *Citrus* in Sicily, and some individuals confined with leaves of lemon and orange died without feeding. Damage was generally limited to very young trees, the younger leaves being completely destroyed and the older ones falling as a result of the injury. If defoliation was complete, the green bark was also attacked. New shoots put out by the trees were immediately destroyed.

Experiments on control were carried out in 1954–55. In a field test on lemon, sprays of chlordane or of 0·1 per cent. DDT, alone or with lead arsenate, applied to the defoliated trees, lost their effectiveness in 4–5 days, due to the intensity of the light and the high temperatures to which the deposits were exposed. In laboratory spray tests, DDT and lindane [γ BHC] gave good control both as stomach poisons and as contact insecticides, and appeared to give better coverage of the leaves than lead or aluminium arsenate, which gave inconsistent results. In 1955, dusts containing 6 per cent. aldrin or heptachlor were incorporated into the soil to a depth of 2½–6 ins. round the bases of the trees (over a radius of about 20 ins.) at the rate of 0·7 oz. per tree, to control weevils sheltering in the soil. Some trees were also sprayed, as an auxiliary measure, with emulsions of 0·125 per cent. dieldrin or heptachlor, and others received the spray treatments alone. The treatments were applied on 8th July. After 20 days, infestation had been completely checked on all trees receiving soil treatment, but spraying alone was no better than no treatment. Good results were also given by an adhesive applied round the trunks.

SANKARAN (T.). **The natural Enemies of** *Ceroplastes pseudoceriferus* **Green (Hemiptera-Coccidae).**—*J. sci. Res. Banaras Hindu Univ.* **5** no. 1 pp. 100–119, 1 pl., 27 refs. Benares [1955].

Ceroplastes pseudoceriferus Green [*cf. R.A.E.*, A **23** 607] infests various plants, including mango, in Benares, but has not become a serious pest, although the females lay up to 10,000 eggs or more each. Since this was thought to be due to natural enemies, these were investigated in 1950–52, and a list of those found is given, together with notes on their bionomics. The commonest parasite of the adult females was *Anicetus dodonia* Ferrière, which is widely distributed in India and also attacks the nymphs of both sexes. It was rare between March and August, but had several generations a year. Parasitism was heavy in August–October, when the females of *Ceroplastes* were maturing and beginning to oviposit. Only one parasite developed per nymph, but up to 21 emerged from single adult females. If the hosts were already mature or gravid when attacked, they were able to deposit a small proportion of their eggs. Should this parasite be used for biological control, for which it appears promising, releases should be timed so that the Coccids are parasitised before becoming mature. Other parasites observed comprised an undescribed species of *Diversinervus*, of which 16

adults were reared from one female collected on mango, *Aneristus ceroplastae* How. and *Coccophagus bivittatus* Comp., which parasitised the nymphs, a single individual completing its development in each host, *C. ochraceus* How., which is an ectoparasite of the nymphs, *Coccophagus* sp., which emerged from male nymphs, and *Tetrastichus* sp., which may have been hyperparasitic; *Diversinervus* and the three species of *Coccophagus* had not previously been recorded from India. The eggs of *Ceroplastes* were destroyed by larvae of *Anysis alcocki* (Ashm.), *Monomorium* sp. (in the laboratory) and *Crematogaster* sp., the last reaching them through the exit holes of *Anicetus dodonia* in the adult scale. The larvae of a species of *Scymnus* (*Pullus*) fed on both eggs and nymphs. A table showing the seasonal sequence of these natural enemies in relation to the life-cycle of *Ceroplastes* is appended.

Kono (T.). **Rice Weevil.** [*In*] Kihara (H.). Ed. Fauna and Flora of Nepal Himalaya. Scientific Results of the Japanese Expeditions to Nepal Himalaya 1952–1953 **1** pp. 383–385, 6 refs. Kyoto, Fauna Flora Res. Soc., 1955.

Calandra oryzae (L.) is a cosmopolitan pest of stored grain and is thought to have originated in India. Adults collected in central Nepal in 1952–53 were studied in the laboratory, and those from wheat, barley and maize in ten localities were found to belong to the small strain of this weevil [*cf. R.A.E.*, A **33** 361], whereas those from barley in another were of the large strain. The small strain from Nepal was larger than that from other regions, and the difference between it and the large strain consequently less. In reciprocal crosses, the small strain from Nepal interbred with the small strain from Japan and Australia, but not with the large strain from Japan. Adults of the small strain from Nepal are able to fly, whereas those from Japan are not, and infestation in Nepal consequently began in the field before the grain was harvested.

Baptist (B. A.) & Ranaweera (D. J. W.). **The Scarlet Mites of the Genus *Brevipalpus* as Pests of Tea in Ceylon.**—*Tea Quart.* **26** pt. 4 pp. 127–137, 2 pls., 16 refs. Talawakelle, 1955.

Three species of *Brevipalpus* infest tea in Ceylon and are briefly described. They are *B. australis* (Tucker), which was previously recorded as *B.* (*Tenuipalpus*) *obovatus* Donn. [*cf. R.A.E.*, A **35** 3; **36** 368] and is the commonest, *B. phoenicis* (Geijskes), which also infests shade trees, notably *Grevillea robusta* and *Albizzia moluccana*, and *B. inornatus* (Banks). Observations on the bionomics of *B. australis* were made at a place where the maximum day and minimum night temperatures averaged about 74 and 64°F., respectively, and showed that males were rare; pairing was not observed. The females oviposited within 3–4 days of becoming adult and laid about one egg a day each for an average of seven weeks, the total numbers of eggs per female ranging up to 54 and averaging 43. The eggs are laid on the lower surfaces of the leaves and hatched in 13 days in the laboratory. The larval, protonymphal and deutonymphal stages comprised feeding periods averaging 4·2, 4·7 and 4·5 days, respectively, followed by quiescent periods averaging 3·3, 3·3 and 3·8 days, and the total life-cycle from egg to adult lasted 36–37 days [*cf.* **25** 334]. The development of *B. phoenicis* was similar.

The mites feed on the lower surfaces of the leaves, chiefly along the petiole and midrib, and cause a red discoloration, leading to dropping of the leaves and a reduction in size of the new foliage. Heavily infested branches often

fail to survive pruning. The mite population increases slowly, however, and normally requires about three years to reach economic proportions on pruned bushes, though it may do so much more rapidly if conditions are favourable. Development is most intense in January–March, when the variation between day and night temperatures is greatest. Pruning affords important mechanical control, but the shade trees should be lopped or pollarded just before, to prevent reinfestation. The mites are also reduced by heavy continuous rain. Tests on control were carried out with sprays of 1 lb. wettable sulphur per 25 gals. water, 1 gal. lime-sulphur per 40 gals., 0·025 per cent. Chlorobenzilate (ethyl 4,4′-dichlorobenzilate), or 1 lb. 25 per cent. wettable Karathane (2,4-dinitro-6-(1-methylheptyl)phenyl crotonate) per 25 or 100 gals., and dusts of sulphur or 2 per cent. Chlorobenzilate applied at 25–30 lb. per acre. Applications were made at weekly intervals, and reductions in population were estimated by counts of all stages on a prescribed leaf area before and after treatment. In the first test, the respective percentage reductions obtained were 85 and 66 for the sulphur spray and dust and 80 and 62 for the Chlorobenzilate spray and dust two days after the last of three applications, as compared with a 50 per cent. increase in population on untreated bushes, and in the second they were 99 and 97 six days after three sprays of lime-sulphur and wettable sulphur, again as compared with an increase for no treatment. A light application of the Chlorobenzilate spray from above proved much less effective, even when repeated three times, than thorough application from above and both sides, and the same spray at half the concentration was ineffective against light mite populations, though it gave appreciable reduction of heavy ones. In the last two tests, the Karathane sprays applied 3–4 times gave 99 per cent. reduction of population within a week of the last application, as compared with 98 and 92 per cent. for the sprays of sulphur and Chlorobenzilate, respectively. None of the acaricides had much effect on the eggs or resting stages, though Karathane caused some egg mortality, and sulphur was found to taint the foliage for up to three weeks after application. The sprays of sulphur, Chlorobenzilate and Karathane are recommended, and directions are given for their most advantageous use.

Baptist (B. A.). **The Tea Leaf-eating Tortrix Caterpillar (*Homona coffearia* Nietn.) as a limiting Factor in Insecticidal Applications on Tea.**—*Tea Quart.* **27** pt. 1–2 pp. 28–35, 14 refs. Talawakelle, 1956.

Homona coffearia (Nietn.) has since 1939 normally been controlled on tea in Ceylon by the introduced parasite, *Macrocentrus homonae* Nixon [*cf. R.A.E.*, A **37** 99]. The life-cycles of the two are well synchronised, and there are about five generations a year. The *Homona* larvae usually feed in nests of leaves, and are thus partly protected from the effects of insecticides, but the parasite is more exposed as it searches the foliage for hosts on which to oviposit. The effect on its action of dieldrin, to which *Homona* appears resistant, applied against the shot-hole borer, *Xyleborus fornicatus* Eichh., was therefore investigated.

In the first trial, an emulsion spray of 0·025 per cent. dieldrin was applied at about 100 gals. per acre at ten-day intervals from August 1953 until late January 1955, after which the intervals were increased to two and later three weeks and the concentration doubled (from late June), until mid-September. Attack by *Homona* did not become noticeable in the block until October–November 1954, about three months after pruning, and was then somewhat more extensive in the sprayed plots than in the untreated ones. It persisted for about six months, and was not affected by spraying the foliage as well as the stems of the bushes. It was controlled by a spray

of 0·125 per cent. DDT in June, and the larvae did not appear again in numbers until early September, when DDT was once more applied. Larvae were collected at intervals from January to October 1955 from the treated and untreated plots and examined. The percentage parasitism was low on each occasion, not exceeding 8 on the treated plots and 19 on the untreated ones, and fell irregularly to 0 on both by late September.

Another block was dusted twice with 2 per cent. dieldrin at 30 lb. per acre, one and 13 weeks after pruning. *Homona* appeared on the dusted but not the untreated bushes four weeks after the second application, and was controlled with the DDT spray. Parasitism was found to be negligible for eight weeks after application of the insecticide. Sprays of dieldrin at 0·1 per cent. were applied 2–4 times in seven other trials, and in five of them *Homona* appeared a few weeks later and showed very little or no parasitism; DDT was required to combat it in some cases. A spray of 0·1 per cent. chlordane applied three times was followed by a severe outbreak, with no parasitism occurring, and DDT was again required. It is concluded that applications of a persistent insecticide effective against *X. fornicatus* will not lead to outbreaks of *H. coffearia* if applied within three weeks of pruning, when fresh foliage is not available, but that later ones should be accompanied or followed by treatment with a material toxic to *Homona* larvae, such as DDT.

De Silva (M. D.). **A new Species of *Helopeltis* (Hemiptera—Heteroptera, Miridae) found in Ceylon.**—*Bull. ent. Res.* **48** pt. 3 pp. 459–461, 1 fig., 3 refs. London, 1957.

Damage to cacao in Ceylon by *Helopeltis* was first recorded about 1880 near Matale, when it affected the young leaves and stems, and has been attributed to *H. antonii* Sign. [*cf. R.A.E.*, A **23** 72], a species described from Ceylon in 1858. At present the pods are chiefly attacked, and damage to the stems and leaves is rare and generally associated with cacao grown in poor shade. Examination of extensive collections of *Helopeltis* from the main cacao-growing areas, including Matale, showed that all were referable to a new species here described from adults of both sexes collected at Teldeniya as *H. ceylonensis*. Characters separating it from *H. antonii* and another closely related species of *Helopeltis* are included.

Bailey (S. W.) & McCabe (J. B.). **A Controller for a Light Source.**—*Bull. ent. Res.* **48** pt. 3 pp. 463–465, 1 pl., 1 fig. London, 1957.

The following is almost entirely the authors' summary. An instrument is described that will brighten and dim a light source and control the periods for which it operates. The periods of brightening and dimming and the period of full illumination are both adjustable, the former from 0·5 to 2 hours and the latter from 8 to 16 hours. The instrument has been used successfully for studying the effects of changing light intensity and photoperiod on the activity and development of insects.

Hill (A. R.). **Observations on the reproductive Behaviour of *Amphorophora rubi* (Kalt.), with special Reference to the Phenomenon of Insect Resistance in Raspberries.**—*Bull. ent. Res.* **48** pt. 3 pp. 467–476, 2 graphs, 10 refs. London, 1957.

The following is based partly on the author's summary. *Amphorophora rubi* (Kalt.) is known to transmit virus diseases of *Rubus* in the United States and Britain, and some restriction of the spread of the diseases has

been obtained in the former country by the use of varieties of raspberry on which the vector feeds with difficulty or not at all [*cf. R.A.E.*, A **28** 583; **35** 298]. Resistance to infestation by the Aphid has also been observed in some raspberry varieties in Holland [*cf.* **40** 279]. Investigations were consequently made in Scotland on the reproductive behaviour of the Aphid on species and varieties of *Rubus* there.

In preliminary tests, the plants used comprised six named and three unnamed varieties of European raspberry (*R. idaeus*), one variety (Cumberland) of black raspberry (*R. occidentalis*), and American red raspberry (*R. strigosus*) and two varieties of it (Newburgh and Latham), as well as loganberry and Viking (hybrids of *R. idaeus* with blackberry (*R. fruticosus*) and *R. strigosus*, respectively) and *R. lambertianus*, and the criterion adopted was the number of progeny produced by a single freshly matured female in 28 days. Five named varieties of *R. idaeus* and the variety of *R. occidentalis* permitted the development of large populations, but two unnamed varieties of *R. idaeus*, the two varieties of *R. strigosus*, and Viking showed considerably more resistance, and no progeny were produced on one named (Malling Landmark) and one unnamed variety of *R. idaeus*, loganberry, *R. strigosus* or *R. lambertianus*. The phenomenon of resistance was then further investigated in three varieties of *R. idaeus*, including one (Lloyd George) not previously tested, and one of *R. strigosus* (Newburgh) from the aspects of the fecundity, reproductive rate, length of life, growth rate and behaviour of the Aphid. The varieties Malling Promise and Lloyd George showed no resistance to the production of offspring by the Aphid [*cf.* **28** 583]. Malling Landmark proved highly resistant, but showed a slight reduction in resistance in autumn. Newburgh appeared to occupy an intermediate position between Malling Landmark and the other two varieties, but there were indications that it might be more resistant in the field than under experimental conditions. Resistance appeared to involve a slowing down of the reproductive rate, a shortening of the length of life of adults and prevention of development of the nymphs.

In a discussion of the practicability of using Aphid-resistant varieties of raspberry to minimise virus spread, it is pointed out that *A. rubi* is able to feed and, to some extent, reproduce, on the senescent foliage of resistant varieties, and that Aphids entering a plantation of a resistant variety are likely to pass through it testing many plants in a search for more suitable food, and, if infected, progressively disseminating the virus.

STUART (A. M.). *Ephialtes brevicornis* (**Grav.**) **as an external Parasite of the Diamond-back Moth,** *Plutella maculipennis* (**Curt.**).—*Bull. ent. Res.* **48** pt. 3 pp. 477–488, 13 figs., 16 refs. London, 1957.

A batch of 5,000 parasitised larvae of *Coleophora frischella* (L.) was collected from *Melilotus altissima* in north-western France and sent by air to New Zealand in August 1955 to provide material for release against *Coleophora* spp. there. The species present in New Zealand are *C. spissicornis* (Haw.) and one that has hitherto been regarded as *C. frischella* [*cf. R.A.E.*, A **41** 26] but is stated in a footnote not to be this species. Three females and five males of *Ephialtes brevicornis* (Grav.) emerged, and an account is given of laboratory observations on the bionomics of this Ichneumonid, together with descriptions of the egg and five larval instars and a list of the hosts from which it has been recorded. The females did not oviposit on last-instar larvae of *Coleophora* spp., but readily attacked prepupae of *Plutella maculipennis* (Curt.), which has not hitherto been recorded as a host of this parasite. When fed on honey solution, females survived for about six weeks at a temperature of about 60°F. and males for

rather less. The females also fed on the body fluids of punctured hosts. Pairing took place immediately after emergence and thereafter throughout life, but oviposition was not observed until 7–10 days after emergence. Host larvae in the final instar were rarely and pupae never attacked. Usually one egg was laid per host, but occasionally two or three and once 12 were found; the larvae fed externally, and only one per host completed its development. At 20°C. [68°F.] and 60 per cent. relative humidity, development from egg to adult lasted 16 days, the egg and pupal stages lasting 1·5 and 6–7 days, respectively.

Solomon (M. E.). **Estimation of Humidity with Cobalt Thiocyanate Papers and permanent Colour Standards.**—*Bull. ent. Res.* **48** pt. 3 pp. 489–506, 1 pl., 21 refs. London, 1957.

The following is virtually the author's summary. The method of measuring relative humidity by matching the colours of tissue paper impregnated with cobalt thiocyanate has now been made more convenient by the commercial production of impregnated paper and coloured glass standards. Although the method as used straightforwardly is not at all precise, it is especially useful for the measurement of humidity in small or relatively inaccessible spaces such as cracks in floors, air spaces in stored grain, under bark, or inside small tubes, and for general use when elaborate equipment cannot be employed. A piece of the paper is exposed to the humidity to be measured, preferably for two hours, then mounted on white opal glass in oil (liquid paraffin) and matched, in a simple comparator, against the coloured glass standards. When matching is done at a temperature other than 20°C. [68°F.], corrections are required as tabulated. Tables of error are given, showing the range of variation from different causes, with estimates of 95 per cent. confidence limits. To cover all the sources of variation normally affecting the measurements under various conditions, limits up to ± 5 are allowed for relative humidities down to 70 per cent.; these limits increase at lower humidities to a maximum of ± 15 at about 30 per cent. Various ways of avoiding errors are described, and it is shown that if special precautions are taken the method can be used with considerable accuracy, particularly at relative humidities above 65 per cent.

Aziz (S. A.). **The Reactions of the Desert Locust, *Schistocerca gregaria* (Forsk.), (Orthoptera, Acrididae) to physical Factors, with special Reference to relative Humidity.**—*Bull. ent. Res.* **48** pt. 3 pp. 515–531, 1 fig., 25 refs. London, 1957.

The following is almost entirely the author's summary. The reactions of three-day-old first- and fourth-instar hoppers of *Schistocerca gregaria* (Forsk.) of phase *gregaria* to relative humidity, temperature and light were studied in an alternative chamber apparatus designed to give an enclosed space with gradients of humidity. The responses to each factor independently and to their interactions were considered. It was found that hoppers in both instars responded strongly to humidity. They were agitated by low, and even more by very high, humidities, but became less active within a zone of 60–70 per cent. relative humidity, where they spent more time. Within this zone they hopped and turned less, and this decrease in activity appeared to be independent of both temperature and light intensity. This zone of decreased agitation is referred to as the zone of minimum activity. However, the speed of walking, in contrast to the other types of activity, increased progressively with humidity. Increase in light intensity increased the duration of activity within the limits of experimental time and the speed of

walking at all humidities. With rise in temperature, there was an increase in hopping, klinokinesis and orthokinesis. The first-instar hoppers responded to the combined effects of increased light and temperature by increased ortho- and klinokinesis, and the fourth-instar hoppers by increased hopping. In fourth-instar hoppers, the speed of walking was significantly increased by increased humidity combined with increased temperature or light. The hoppers were generally more active when starved than when fed, and hoppers that were both desiccated and starved spent somewhat more time in the half of the apparatus having the higher relative humidity than did normal, fed hoppers. Throughout the experiments it was noted that the first-instar hoppers are somewhat more active and hop more, but march less, than those in the fourth instar.

GEORGE (K. S.). **Preliminary Investigations on the Biology and Ecology of the Parasites and Predators of** *Brevicoryne brassicae* **(L.).**—*Bull. ent. Res.* **48** pt. 3 pp. 619–629, 11 refs. London, 1957.

The following is based partly on the author's summary. During 1953 and 1954, an attempt was made to evaluate the degree of control of *Brevicoryne brassicae* (L.) afforded by its parasites and predators by means of fortnightly samples taken in experimental plots of brussels sprouts set up on two sites in eastern England. Each plot comprised a block of five rows of 40 plants, and each main sample consisted of an upper, middle and lower leaf from each of 25 per cent. of the plants. Two such samples were taken at each visit, and the plants were sampled in strict rotation. One sample was used for counts of the Aphids, and the other for an assessment of parasitism. After mummified Aphids had been transferred to labelled tubes and the predators identified and recorded, this latter sample was placed in an insect-proof container and further mummified Aphids were removed each day for a fortnight and kept for the emergence of parasites. The validity of counting Aphids from one sample and natural enemies from another was frequently checked by comparing the Aphid populations in two samples taken from a block of 200 plants selected at random; the numbers were found to be approximately the same when fairly large populations were being considered. A shorter method of assessing parasitism, by the daily removal of mummified Aphids from a batch of 100 large nymphs and adults taken from the main sample used for the assessment of Aphid populations, was tested in 1953. The results indicated the same general trend of parasitism as those from the main sample, but since, probably owing to bias, the sub-samples included a higher proportion of adults and these had been exposed to parasites for longer than the nymphs, the degree of parasitism indicated was higher.

Parasitism was found to range from 0 to 7·2 per cent. and was about 3 per cent. at the peak of Aphid infestation. Many of the mummified Aphids contained overwintering parasites, and about six weeks after Aphids were first found on the crop, 0–60 per cent. of the parasites failed to emerge; by the end of the season this figure had risen to 95–98 per cent. Of the insects that emerged, *Diaeretus rapae* (Curt.), a primary parasite, was the commonest. The hyperparasites, *Charips* sp., *Lygocerus* sp. and *Asaphes vulgaris* Wlk., varied in numbers from site to site and year to year. Of the adults of *Diaeretus* taken throughout the season, about 60 per cent. were females. The predators taken were Syrphids, mainly *Syrphus balteatus* (Deg.), and a Cecidomyiid, *Phaenobremia* sp. Parasites bred from the Syrphid pupae collected comprised *Diplazon laetatorius* (F.), *D. tarsatorius* (Panz.) and *Promethes dorsalis* (Hlmgr.). An investigation of the specificity of *Diaeretus rapae* indicated that it attacks only *B. brassicae* in the field

though it bred in *Myzus persicae* (Sulz.) in the greenhouse. In laboratory tests in which *Aphidius fabarum* Marshall was confined in a cage with *B. brassicae* on brussels sprouts and *Aphis fabae* Scop. on beans [*Vicia faba*] and *Aphidius matricariae* Hal. was confined similarly with *B. brassicae* and *M. persicae*, both on brussels sprouts, only *Aphis fabae* and *M. persicae* were parasitised. *D. rapae* was the only parasite reared in the field from *B. brassicae* on crops adjoining potatoes and beans infested by *M. persicae* and *A. fabae*, respectively, or along the edges of fields and close to hedgerows.

Brookes (R. F.) & others. **The Toxicity of organic Sulphides to the Eggs and Larvae of the Glasshouse Red Spider Mite. I. *SS'*-Disubstituted Alkane-αω-dithiols.**—*J. Sci. Fd Agric.* **8** no. 1 pp. 31–38, 23 refs. London, 1957.

The research that led ultimately to the development of p-chlorobenzyl p-chlorophenyl sulphide (chlorbenside), which is very toxic to the eggs of Tetranychids and also to the young mites [*cf. R.A.E.*, A **42** 67], received its impetus from the discovery of the ovicidal activity of bisphenylthiomethane and 1,2-bisphenylthioethane. Substituted derivatives of these two compounds were tested, and also various bisalkylthioalkanes and bis(heterocyclicthio)alkanes, and the sulphoxides and sulphones of several bisarylthioalkanes. Examples to illustrate the synthesis of these compounds are given. The screening tests were made by dipping leaves of French beans each bearing on the lower surface 30–70 eggs of *Tetranychus telarius* (L.), 1–2 days old, for ten seconds in 0·1 and sometimes 0·025 per cent. dispersions or emulsions of the chemicals and assessing mortality a week later, two days after untreated eggs had hatched. The mortality considered was that of eggs and young mites, and it was corrected for mortality in the untreated controls by the method of Finney [**32** 308]. The full results are shown in a Table.

When bisphenylthiomethane and its αω-bisphenylthioalkane homologues were tested at 0·1 per cent., mortality was high (99–96 per cent.) for the first three members of the series, but decreased rapidly thereafter to 0 for the hexane. It was also 99 per cent. for bis-p-chloro- and bis-m-chlorophenylthiomethane, but only 88 per cent. for the corresponding o-chloro compound, and it was still lower for the corresponding ethanes. Bis-p-fluorophenylthiomethane gave complete mortality, and the ethane 96 per cent. The only other materials to give high kills were bis-o-hydroxyphenylthiomethane (72 per cent.), bis-o-aminophenylthioethane (90 per cent.), and bispyrid-2-ylthiomethane (87 per cent.).

More precise comparisons of the effective materials were made by spraying the lower surfaces of the leaves bearing the eggs in a Potter tower [**29** 591] at a rate giving about 0·3 gm. spray per petri dish 9 cm. in diameter, and assessing mortality as before. In the first of these, bisphenylthiomethane, 1,2-bisphenylthioethane and 1,3-bisphenylthiopropane gave 99, 99 and 94 per cent. mortality at 0·1 per cent., 71, 75 and 62 per cent. at 0·05 per cent., and 35, 29 and 24 per cent. at 0·025 per cent. In the second, the methane and bis-p-, bis-m- and bis-o-chlorophenylthiomethane gave 93, 99, 99 and 84 per cent. mortality at 0·1 per cent., 83, 93, 91 and 58 per cent. at 0·05 per cent., and 50, 86, 83 and 28 per cent. at 0·025 per cent. In the third, the methane and 1,2-bis-m-chloro- and 1,2-bis-o-chlorophenylthioethane gave 98, 82 and 54 per cent. mortality at 0·1 per cent., 83, 55 and 57 per cent. at 0·05 per cent., and 44, 17 and 6 per cent. at 0·025 per cent. In the fourth, the methane, bis-p-chlorophenylthiomethane, the corresponding ethane and bis-o-hydroxyphenylthiomethane gave 95, 98, 49 and 78 per cent. mortality at 0·1 per cent., 79, 88, 17 and 49 per cent. at 0·05 per cent., and 32, 55,

5 and 30 per cent. at 0·025 per cent. In the fifth, the methane, the corresponding ethane, and their bis-p-fluorophenyl analogues gave 69, 72, 82 and 99 per cent. mortality, respectively, at 0·05 per cent., 28, 31, 48 and 68 per cent. at 0·025 per cent., and 5, 11, 11 and 29 per cent. at 0·0125 per cent.

Finally, bisphenylthiomethane and 1,2-bisphenylthioethane were compared with azobenzene, CPBS (p-chlorophenyl benzenesulphonate) and CPCBS (p-chlorophenyl p-chlorobenzenesulphonate). The mortality percentages for eggs and young mites and (in brackets) eggs only were 100 (99), 86 (86) and 45 (42) for the methane at 0·08, 0·04 and 0·01 per cent., respectively, 97 (95), 79 (76), and 20 (19) for the ethane, 87 (87), 66 (62) and 10 (10) for azobenzene, 100 (99), 99 (98) and 95 (59) for CPBS, and 100 (100), 100 (99) and 94 (43) for CPCBS, indicating that CPBS and CPCBS gave much higher kills than the methane and ethane at the lower concentrations, though the latter were superior to azobenzene.

Mal'kovskiĭ (M. P.). **Contributions to the Biology of the Wingless Grasshopper, *Gomphomastax clavata clavata* Ostr. (Orthoptera, Eumastacidae).** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 1 pp. 43–49, 2 figs., 6 refs. Moscow, 1956.

Considerable damage was caused in 1940 to the leaves of strawberries, raspberries and currants near Alma-Ata by nymphs and adults of *Gomphomastax clavata* (Ostr.), and observations were therefore carried out in 1941–42 on the local distribution, food-plants and bionomics of this Eumastacid. It occurred in hilly or mountainous districts up to elevations of about 6,000 ft., but was most numerous at lower altitudes in areas covered with bushes, wild fruit trees and other broad-leaved vegetation. It fed on numerous wild and cultivated plants, and among the latter it appeared to prefer fruit bushes, damaging up to 19, 12 and 30 per cent. of the foliage of strawberries, raspberries and currants, respectively. It had one generation a year, the nymphs hatching between mid-April and the beginning of May and giving rise to adults in early June. Pairing was observed on 7th June and reached its peak on 18th June, and 11 caged females deposited a total of 75 egg-pods, each of which contained 4–8 eggs. The egg-pods were deposited near the feeding sites, and the adults died out by the end of August. In some places, up to 53 per cent. of the nymphs and adults were parasitised by an unidentified Mermithid. For control, dusting with DDT or calcium arsenate against the nymphs is recommended.

Khadzhibeĭli (Z. K.). **Coccids (Homoptera, Coccoidea) injurious to Oaks in Georgia.** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 1 pp. 50–55, 2 figs., 3 refs. Moscow, 1956.

The author gives a list of 12 Coccids that infest oaks of various species in Georgia, and reviews the bionomics, natural enemies and importance of the three most injurious. These are *Asterolecanium minus* Ldgr., *Eulecanium rufulum* Ckll. and *Diaspidiotus zonatus* (Frnf.).

Brunner (Yu. N.). **A new Pest of Sugar-beet in Uzbekistan—the Weevil, *Temnorrhynus brevirostris* Gyll. (Coleoptera, Curculionidae).** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 1 pp. 60–64, 5 figs. Moscow, 1956.

Cleonus (*Temnorhinus*) *brevirostris* (Gylh.), all stages of which are briefly described, causes considerable damage to sugar-beet near Samarkand, where the crop is a fairly new one. The adults feed on the cotyledons and leaves

of the young plants, causing up to 25 per cent. loss of foliage, and the larvae attack the underground parts, killing up to 23 per cent. of the plants.

Observations on the bionomics of the weevil in 1949–53 showed that it had one generation a year, the adults overwintering in the soil at depths of about 3–6 ins., or sometimes in dry litter on the surface, mostly in uncultivated fields or those previously under sugar-beet. Its main food-plant was *Spinacia turkestanica*, a common weed. In spring, the overwintered adults appeared in the first half of March and migrated to fields of sugar-beet at the end of March and the beginning of April, gradually spreading throughout them. Pairing and oviposition began in early April and continued until the end of June, when the majority of the adults died. The eggs were laid on the leaves or cotyledons, mostly in the first half of April. The larvae hatched in 8–14 days, fed on the leaves for 1–2 days, and then fell to the ground, entered the soil and attacked the subterranean parts of the plants. The larval stage lasted about 65 days. Pupation took place in the first half of June, and the adults emerged within a fortnight and entered hibernation without leaving the soil. Some 2–3 per cent. of the eggs were attacked by an unidentified parasite, and up to 50 per cent. of the larvae, especially those that hatched from eggs deposited after mid-May on older plants, died without being able to reach the underground parts. Many were killed by ants and other predators, and about 6–8 per cent. of all stages in the soil were destroyed by entomogenous fungi and bacteria. Irrigated fields were generally free of infestation. In preliminary tests, dusting with DDT and BHC gave promising control of the adults.

Moiseev (A. E.). **The Flea-beetle, *Psylliodes cucullata* Ill. (Coleoptera, Chrysomelidae), and its Control.** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 1 pp. 65–68. Moscow, 1956.

Psylliodes cucullata (Ill.), of which all stages are briefly described and the distribution reviewed, had not previously been considered a pest of agricultural crops in the Soviet Union, but was found in 1946 attacking *Agropyrum cristatum* and *A. desertorum* grown for fodder or seed in the Province of Saratov. Observations in 1946–49 showed that the main damage was caused by the adults, which fed on the leaves and ears, and that injury to the rootlets by the larvae caused little loss. The flea-beetle was numerous only in stands 3–4 years old, and *A. desertorum* was more severely damaged than *A. cristatum*. It had one generation a year, and the full-fed larvae overwintered in the soil at a depth of about 8 ins. Most of them pupated in mid-May, and the pupal stage lasted 9–10 days, the adults emerging at the end of May or the beginning of June, when the ears of *A. cristatum* were formed and those of *A. desertorum* appearing. The eggs were laid in the soil, and hatched in 8–19 days in the laboratory at 24–30°C. [75·2–86°F.]. The control measures recommended include crop rotation, the use of mobile traps, and dusting with 12 per cent. BHC, 5 per cent. DDT or calcium arsenate at minimum rates of 9, 10·8–13·5 and 9 lb. per acre, respectively, chemical control being recommended only for crops grown for seed and for large populations on natural grassland, which may serve as a source of crop infestation. Control on hay crops is best effected by early cutting.

Bogush (P. P.). **On the Spring Generation of the Cotton Noctuid in the Murgab Valley.** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 1 pp. 80–84. 3 refs. Moscow, 1956.

Although most of the pupae of *Heliothis armigera* (Hb.) (*Chloridea obsoleta* auct.) overwintering in cotton fields in Turkmenia are destroyed by ploughing

in spring, this Noctuid appears on cotton in numbers about June every year, so that considerable populations must persist elsewhere. The overwintering pupae have been found capable of resuming development at 15·5°C. [59·9°F.] in the laboratory [*R.A.E.*, A **27** 147], and since the temperature in the south of Turkmenia, notably in the valley of the Murgab, reaches that level by April, it was thought that a spring generation of the moth may develop in the valley. This view was supported by the taking of adults in light-traps from between 25th February and 6th May in various years. In investigations in 1951–53, overwintering pupae kept in cages in the soil in a lucerne field from October–November and taken to the insectary between the end of February and mid-May gave rise to adults in April–May. Eggs were collected in the field in the early spring of 1953, and larvae were numerous in May on various plants including tomato, cotton, chick pea [*Cicer arietinum*] and lucerne in several years. When taken to the laboratory, they gave rise to adults in late May or June. The occurrence of a spring generation was thus apparently a regular phenomenon in the area. Lucerne fields were found to be the principal source of the moths that migrate to cotton and larvae were observed in them in May feeding not only on lucerne but also on *Chenopodium album* and the flowers of *Convolvulus arvensis*. In feeding tests, the larvae were reared on lucerne, cotton, chick pea, *Chenopodium* and the flowers of *Convolvulus arvensis*, and the females that emerged laid eggs, though the latter were not always viable. Though the larvae were numerous in lucerne fields in the spring of 1953, no outbreak occurred, 61 per cent. of them being parasitised and many others destroyed by insect predators.

Gerasimov (A. M.) & Kreĭtsberg (V. É.). *Recurvaria pistaciicola*—**a Pest of Pistachio in Central Asia.** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 1 pp. 85–88, 1 fig. Moscow, 1956.

Recurvaria pistaciicola Danilevskiĭ, the larva, female pupa and adults of which are described, infests the fruits of pistachio (*Pistacia vera*) in Uzbekistan, Turkmenia, Tadzhikistan, Persia and Afghanistan, causing crop losses of up to 40 per cent. in Uzbekistan. Observations on its bionomics showed that it had two–three generations a year, hibernating in the pupal and adult stages. Adults were active from the end of April to the end of May, and eggs were laid at the rate of one per newly set fruit. The larvae hatched in 6–8 days and entered the fruits, each migrating successively to 5–8 and causing them to fall prematurely. They became full-fed in 26–32 days and pupated in crevices in the bark and in litter beneath the trees. Some of the adults emerged in June–July, and these oviposited on galls caused by Aphids. The resulting larvae fed on the inner walls of the galls, and gave rise to a third generation that attacked the pericarps and seeds of the ripening pistachio fruits. Most of the adults of the first generation emerged at the beginning of August, and these oviposited directly on the ripening fruits. In an experiment, scraping loose bark from the trees and removing the litter in winter reduced infestation of the fruitlets by 70–90 per cent. and that of the ripe fruits by 50–80 per cent.

Shapiro (I. D.). **On Injury to Cereals caused by Pests in the Province of Leningrad in 1952.** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 1 pp. 139–141, 3 refs. Moscow, 1956.

Many insect pests were unusually numerous in the Province of Leningrad and adjacent areas in 1952, presumably owing to the preceding mild autumn

and winter, and serious damage was caused to the developing seeds of cereals, notably winter rye and spring wheat, by bugs of the genera *Lygus* and *Stenodema*. The predominant species was *Lygus rugulipennis* Popp. (*pubescens* Reut.), and injured grains showed reduced weight and germinating capacity. Rye and wheat were also heavily infested by *Apamea* (*Trachea*) *basilinea* (Schiff.).

Lindquist (D. A.) & Dahm (P. A.). **Metabolism of radioactive DDT by the Madeira Roach and European Corn Borer.**—*J. econ. Ent.* **49** no. 5 pp. 579–584, 4 figs., 29 refs. Menasha, Wis., 1956.

The following is substantially the authors' summary. The absorption, metabolism and excretion of ^{14}C-ring-labelled p,p'DDT in adult females of the Madeira cockroach (*Leucophaea maderae* (F.)) and fifth-instar larvae of the European corn borer (*Pyrausta nubilalis* (Hb.)) were studied. The cockroach absorbed DDT rather slowly (about 90 per cent. in 20 days) and excreted 50 per cent. of the total applied radioactivity over a period of 36 days. Separation of the radioactive compounds excreted in faeces by DDT-treated cockroaches was accomplished by paper chromatography. The presence of DDT, DDE (2,2-bis(p-chlorophenyl)-1,1-dichloroethylene) and three unidentified metabolites was demonstrated. DDT was the predominant radioactive compound excreted in the first 24 hours after treatment, after which a metabolite with an R_f value of about 0·88 was the major radioactive compound excreted. Metabolic pathways for DDT in the cockroach are proposed.

Fifth-instar larvae of *P. nubilalis* have some tolerance of DDT and convert significant amounts of absorbed DDT to DDE. No evidence of DDT metabolites other than DDE was found. Both colorimetric and radiometric analyses were used in the study of *P. nubilalis*.

Jefferson (R. N.), Bald (J. G.), Morishita (F. S.) & Close (D. H.). **Effect of Vapam on *Rhizoglyphus* Mites and *Gladiolus* Soil Diseases.**—*J. econ. Ent.* **49** no. 5 pp. 584–589, 1 fig., 9 refs. Menasha, Wis., 1956.

Collections made during the last few years have indicated that *Gladiolus* and other bulb crops in southern California are infested by a complex of mites of the genus *Rhizoglyphus*. They cannot at present be identified, but the type of damage and the conditions under which it occurs appear to be similar to those associated with infestation by *R. rhizophagus* Banks and *R. solani* Oudm. *Rhizoglyphus* mites are closely associated with soil-borne diseases of *Gladiolus*, the most important of which are due to *Fusarium oxysporum* f. *gladioli*, *Stromatinia gladioli* and *Pseudomonas marginata*, and a fumigant that controls the mites but not the diseases would be of no practical value. Vapam (sodium N-methyl dithiocarbamate dihydrate), a general soil fumigant, proved effective against the mites in preliminary experiments and was therefore tested under field conditions against both mites and diseases. In the main experiment, the fumigant was applied at 215, 430 and 860 lb. per acre to prepared, heavily infested soil and watered in, on 8th September 1954 and 3rd March 1955, or on 4th March only, and corms were planted on 17th March and dug on 23rd September 1955.

Treatments increased the percentage of plants that flowered and the yield of corms, and the former was further increased by dipping the corms in New Improved Ceresan [ethylmercury phosphate] before planting. The incidence of *Fusarium* and probably of *Stromatinia* was reduced, and there

was a consistent fall in the degree of *Pseudomonas* infection of undipped corms with increased fumigant dosage, though very irregular results were obtained with dipped ones. When the planting stock was not dipped in Ceresan, the numbers of mites on harvested corms decreased progressively as the dosage of fumigant increased, all treatments causing significant or nearly significant reductions. After dipping, the results were extremely erratic, probably because of the association of the mites with *Pseudomonas*.

The results indicated that the fumigant is moderately effective against the diseases and that its value depends largely on the degree of infestation of the soil and on climatic and cultural conditions. Dosages of 300–400 lb. per acre appear practicable when both costs and increased production are considered.

Diehl (S. G.) & Chatters (R. M.). **Studies on the Mechanics of Feeding of the Spotted Alfalfa Aphid on Alfalfa.**—*J. econ. Ent.* **49** no. 5 pp. 589–591, 4 figs., 4 refs. Menasha, Wis., 1956.

The following is substantially the authors' summary. Lucerne leaves infested by *Myzocallis* (*Therioaphis*) *maculata* (Buckt.) were examined by histological and cytological methods. The results showed that the insect inserts its stylets intercellularly and feeds within the phloem and mesophyll parenchyma; considerable quantities of saliva or other toxic substances are injected into the tissues. The greatest damage is evident within the mesophyll, where the toxicants appear to cause lysis of the cytoplasm; these areas may be visually correlated with the macroscopic chlorotic areas of the leaves. Removal of manufactured foods by phloem feeding probably occurs and would doubtless help to weaken the plant. No attempt was made to determine the contribution of each of the feeding methods to total damage.

Daniels (N. E.) & Porter (K. B.). **Greenbug Damage to Winter Wheat as affected by preceding Crop.**—*J. econ. Ent.* **49** no. 5 pp. 600–602, 4 refs. Menasha, Wis., 1956.

Several severe outbreaks of *Toxoptera graminum* (Rond.) on wheat have occurred in the central and south-eastern United States, and the Aphid causes some damage every year. Wheat following leguminous crops often appeared to be more tolerant of attack than wheat following other plants, and investigations were made in Texas in 1954–55 on the fecundity of the insect on wheat grown in different soils in the greenhouse.

Samples of soil were taken from depths of 0–1, 1–2, 2–3 and 3–4 ft. in a wheat field and in one in which lucerne had been grown for five years. Pawnee wheat was sown in soil from each sample and in mixtures of the first and last and of all four samples, and the plants were infested with one adult of *T. graminum* each when three inches high, or left uninfested, and covered with cages. Examination 30 days later showed that populations were greater and both infested and uninfested plants heavier in the soil from the top foot and in the mixed soils than in others and in soil from the lucerne field than in that from the wheat field. All infested plants were severely damaged, and reductions in weight due to infestation were greater on the more vigorous plants, probably owing to the greater numbers of insects produced on them.

Soil analysis showed that the proportion of nitrogen was higher in the top foot than at greater depths and in lucerne than in wheat soil; there was more

available phosphorus at the greater depths and in the lucerne soil. Statistical analysis indicated that the number of insects per plant was positively associated with plant vigour and the percentage of nitrogen in the soil.

Guthrie (F. E.), Rabb (R. L.) & Van Middelem (C. H.). **Control of Aphids on Cigar-wrapper and Flue-cured Tobacco.**—*J. econ. Ent.* **49** no. 5 pp. 602–606, 1 fig., 9 refs. Menasha, Wis., 1956.

In the district of Florida in which cigar-wrapper tobacco is grown under cloth tents, insecticides applied by aeroplane when the plants are about half grown have given satisfactory control of budworms [*Heliothis virescens* (F.)] and *Myzus persicae* (Sulz.). The amounts prevented by the tents from reaching the plants, determined by exposing filter papers immediately above and below the cloth just before treatment, were found to be 34–38 and 61–66 per cent. for a 10 per cent. DDT dust when the cloth was dry and damp with dew, respectively, and 48–59 per cent. for a DDT emulsion spray when the cloth was dry.

Some of the newer insecticides were tested against the Aphid on artificially infested tobacco in 1953 and 1954, when dusts were applied with a rotary hand duster once a week from mid-April, at rates increasing from 8 to 25 lb. per acre as the plants grew. In 1953, 5 per cent. malathion and a mixture of 2·5 per cent. Metacide (methyl-parathion and parathion) and 10 per cent. DDD (TDE), and in 1954, 1 per cent. endrin with either 2·5 per cent. Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] or 5 per cent. malathion, and 2·5 per cent. isodrin with 5 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], were as effective as the standard mixture of 1 per cent. parathion and 10 per cent. DDD; subsequent experiments indicated that the phosphorus compounds were mainly responsible for control. Applications of the standard treatment once a fortnight prevented the development of injurious populations, and 2 per cent. endrin applied weekly gave considerable protection until late in the season; 10 per cent. Strobane [a chlorinated mixture of α-pinene isomers with a chlorine content of approximately 66 per cent.] and 1·5 per cent. lindane [γ BHC] were ineffective.

In tests of applications to flue-cured tobacco made when the plants were 2–4 and 4–7 ft. high, in 1954 and 1955, respectively, 0·15–0·25 lb. parathion, 0·75–1 lb. malathion and 1 lb. Chlorthion per acre in sprays and 0·3 lb. parathion and 1·2 lb. malathion per acre in dusts gave 91–99 per cent. reduction in Aphid populations after 2–14 days, DDD at 0·7 lb. per acre in a spray and 3·7 lb. in a dust had some effect but did not afford commercial control, and endrin reduced populations appreciably at 0·29 lb. per acre in a spray but was less effective at lower rates.

Collins (W. E.). **On the Biology and Control of *Drosophila* on Tomatoes for Processing.**—*J. econ. Ent.* **49** no. 5 pp. 607–610, 11 refs. Menasha, Wis., 1956.

Species of *Drosophila* and other Drosophilids have recently become of importance in the United States as pests of tomatos for canning [*cf. R.A.E.*, A **45** 277–278, etc.], and observations in New Jersey in 1952–53 showed that they were numerous in tomato fields in the harvest season, *D. melanogaster* Mg., *D. tripunctata* Lw., *D. simulans* Sturt. and *Scaptomyza adusta* (Lw.) being present in numbers, and the first being the most abundant of all. Most eggs were deposited in September, and the females oviposited in slit tomatos in all stages of ripeness, with little or no preference after the

fruits had changed colour. Observations at a canning factory in the autumn of 1952 showed that *D. melanogaster* was by far the most abundant species there, *D. buscki* Coq. second in importance, and *D. tripunctata*, *D. hydei* Sturt. and *D. immigrans* Sturt. present in small numbers. When a fog generator was used to apply insecticides in a canvas semi-enclosure to truck-loads of 250–300 baskets of tomatos, penetration through and over the truck appeared to be excellent, but that through individual baskets was poor. Treatment for 30–45 seconds, using about 1 U.S. quart material per load, resulted in complete mortality of test insects (adults) with 2 per cent. lindane [almost pure γ BHC], irrespective of position, but poor control with either pyrethrum or allethrin with piperonyl butoxide, allethrin with butoxy polypropylene glycol, or DDT. No residues of BHC or DDT were found on treated fruits. Counts of *Drosophila* eggs and larvae in the processed juice of tomatos from a field that had been sprayed 11 times at intervals of 10–11 days during the growing season showed 78·2 per cent. reduction in numbers for DDD (TDE) and considerable reductions for methoxy-DDT (methoxychlor), DDT, alone or with parathion, and calcium arsenate, alone or with parathion.

Van Middelem (C. H.), Wilson (J. W.) & Hanson (W. D.). **Sampling Studies related to Insecticide Residues on Cabbage and Celery.**— *J. econ. Ent.* **49** no. 5 pp. 612–615, 1 fig., 5 refs. Menasha, Wis., 1956.

The authors point out that quantitative chemical analysis of insecticide residues is of no value unless the method used for sampling the plant is adequate. Valid and representative samples are more difficult to obtain from a leafy crop than from fruit, and many of the common methods of analysis are more difficult to apply to them. In view of these difficulties, field-scale evaluations on celery and cabbage were carried out and supplemented by laboratory studies of procedural variation and costs. Parathion sprays were applied once to celery in April 1954 and to cabbage plants in March 1955, and samples of ten plants were taken 2–3 hours later, after the spray had dried. The celery stems were cut up and well mixed before sub-samples were taken for extraction with benzene, and 5–6 layers of outer leaves from the cabbage heads were similarly treated and extracted with hexane. The extracts from celery were stored for two weeks and those from cabbage for 6–8 weeks at 40°F. before being analysed. The following is substantially the authors' summary of their analysis of the results.

The determination error was over twice as high for cabbage as for celery, and the laboratory error accounted for 45 and 24·3 per cent. of the total error in the cabbage and celery tests, respectively. The cutting and extraction error was relatively insignificant. The plant-to-plant and plot-to-plot percentages of the total variation were 34·3 and 36 per cent., respectively, for celery, and 31·9 and 17·7 per cent. for cabbage. It was found that the determination errors progressively increased from preliminary tests, in which parathion was merely added to pure benzene, to the experiments in which celery and cabbage extracts taken from field-sprayed samples were used. Estimated plot costs accounted for 60 per cent. of the total variable costs involved in obtaining one laboratory determination, cutting, extraction and the actual laboratory procedures for about 32 per cent., and obtaining the plant samples in the field for about 8 per cent. Preliminary laboratory tests indicated that the steps of reduction and evaporation contribute most of the total analytical error, and further studies will be directed to these. The use of variance components showed that if conditions permit, 30 celery plants or 35–40 cabbage heads per plot should be sampled. These should be cut and mixed, and one sample drawn for extraction. Duplicate analyses for

celery and triplicate analyses for cabbage should be run on each composite extraction, and as many replicates should be used as are necessary to achieve the desired precision or as costs will allow.

Newton (R. C.). **Digger Wasps, *Tachysphex* spp., as Predators of a Range Grasshopper in Idaho.**—*J. econ. Ent.* **49** no. 5 pp. 615–619, 6 figs., 11 refs. Menasha, Wis., 1956.

The following is based on the author's summary. *Tachysphex tenuipunctus* Fox and two unnamed species of the same genus were observed preying on *Oedaleonotus enigma* (Scud.) during an outbreak of this grasshopper on rangeland in south-central Idaho in 1954, and reduced populations from 20–30 per sq. yard to one in five sq. yards over the area under study during June. The female Sphegids dug shallow holes in the soil and then found, stung and paralysed grasshopper nymphs and dragged them into the burrows, 1–2 in each. An egg was laid on one nymph per hole, and the entrance covered. The larvae hatched in 2–3 days, killed their hosts two days later and completed their growth in ten days. Winter was passed by the mature larvae within hard soil-covered cocoons, pupation took place early in May, and the adults emerged between mid-May and mid-June. About 10 per cent. of the larvae and paralysed nymphs were attacked by the larvae of a small Sarcophagid, *Taxigramma heteroneura* (Mg.), which consumed both.

Fleschner (C. A.), Badgley (M. E.), Ricker (D. W.) & Hall (J. C.). **Air Drift of Spider Mites.**—*J. econ. Ent.* **49** no. 5 pp. 624–627, 2 graphs, 6 refs. Menasha, Wis., 1956.

The authors record observations on the air drift of Tetranychids, made in the course of investigations on the biological control of plant-feeding mites in southern California in 1950–55. The following is based largely on their summary.

A mass wind-borne migration of *Metatetranychus citri* (McG.) was seen early in 1951, in which females descended on silken threads from the leaves of *Citrus* trees in a heavily infested grove and were carried by gentle breezes across a road to an uninfested grove, in which a population of economic importance soon developed. The movement continued for several days. In a greenhouse 12 ft. square, females were found to be carried by air currents from six young lemon trees to upright wooden poles about 2 ft. from the walls in the corners. The numbers drifting to these daily were correlated with the populations on the trees, but there was little drift until the population reached 8·6 females per leaf. Rapid increases in mite population followed periods of flush growth, and the movement of large numbers of mites after each rapid increase was thought to be due to depletion of the food supply. There were no such movements of *Tetranychus telarius* (L.) from greenhouse *Citrus* trees.

Field studies of *Oligonychus punicae* (Hirst) in an avocado grove in 1954 showed that females began to descend on threads and to drift soon after sunset when the air was calm, continuing throughout the night in suitable weather. Trapping of females at the top of a 20-ft. pole indicated an extensive upward drift on rising air currents, which undoubtedly results in rapid distribution over considerable distances. Migration did not occur during wind and may be mainly in the direction opposite to that of the prevailing wind. On a tree from which natural enemies of the mite had largely been eliminated by spraying with DDT, spinning and drifting increased in intensity from 28th

August to 11th September and remained considerable until the end of the experiment on 8th October; often as many as 25–50 per cent. of the entire adult female population moved from tree to tree or from leaf to leaf every 24 hours. Similar investigations in the same grove showed that *Eotetranychus sexmaculatus* (Ril.) behaved in the same way.

Grosch (D. S.). **Induced Lethargy and the Radiation Control of Insects.** —*J. econ. Ent.* **49** no. 5 pp. 629–631, 13 refs. Menasha, Wis., 1956.

In the experiments described, adult females of *Bracon hebetor* Say were subjected to various doses of X-rays and kept at about 30°C. [86°F.] without food or with freshly paralysed *Ephestia* larvae renewed each day. When provided with food, insects that had received doses of 25,000–102,000 röntgens lived for about 11–13 days and those receiving 180,000 r. for 7–7·5, whereas untreated ones lived for about 21 days; without food, untreated insects had a life span of about seven days and those receiving 25,000 and 180,000 r. shorter and not significantly longer ones, respectively, whereas those receiving 50,000 and 102,000 r. lived for some 9 and 10–12 days, respectively. After treatment with the two highest doses, the insects died apparently without feeding, even in the presence of paralysed larvae; they remained in a state of lethargy until death, and therefore did not exhaust their reserves as rapidly as normal starved insects. Those receiving the lower doses retained an interest in food, but did not live for more than two-thirds as long as untreated insects. No marked biochemical disturbances could be demonstrated after irradiation, but the knockdown and twitchings observed may indicate an effect on the nervous system. For control of insects it is suggested that if the presence of non-feeding sterile adults is not objectionable, doses that suffice to induce lethargy may prove more feasible than fast-killing doses. The life-span of *B. hebetor* was found to increase considerably as the temperature fell, and products infested by pests should therefore not be stored in cool conditions after irradiation.

Dogger (J. R.). **Thrips Control on Peanuts with granulated Insecticides.** —*J. econ. Ent.* **49** no. 5 pp. 632–635, 8 refs. Menasha, Wis., 1956.

Although their economic importance is difficult to evaluate, thrips cause sufficient damage to groundnuts in North Carolina to require control. The main injury is caused by feeding on the unopened terminal leaflets, and *Frankliniella fusca* (Hinds), which breeds on the leaves, is largely responsible for it. *F. tritici* (Fitch) has been found associated with the damage, but occurs only in small numbers and breeds only in the flowers.

Experiments on the control of *F. fusca* were carried out under the dry conditions prevailing in the coastal plain of North Carolina during the growing seasons of 1953–54, and the quantities of insecticide given are of technical material per acre. In 1953, granular formulations of insecticides were applied to the soil on 22nd May, and insect counts on 15th–18th June showed that 2 lb. aldrin gave almost complete control and that 0·6 lb. dieldrin was better than 1·5 lb. heptachlor or 14·6 lb. toxaphene, which halved the population, as compared with untreated plots. The application of 0·7 lb. DDT in a 5 per cent. dust to the foliage on 18th June further reduced populations considerably, but also reduced yields. In 1954, the granular formulations were applied on 1st–2nd June, and 2·3–3 lb. aldrin proved the most effective, 1·1 lb. parathion and 1·2–1·5 lb. dieldrin were better than 1·4–1·5 lb. heptachlor, and 20 lb. toxaphene was ineffective. Dusts and sprays were applied to the foliage on 23rd June, and DDT at 1 lb.

in a dust or 0·75 lb. in a spray and 1·5 lb. toxaphene in a spray were the most effective, whereas 1·5 lb. Strobane [a wettable powder containing a chlorinated mixture of α-pinene isomers with a chlorine content of approximately 66 per cent.] in a spray gave poor results; 0·4 lb. parathion and 1 lb. malathion, in a dust and spray, respectively, were applied on both 23rd June and 9th July and gave promising results. No simple association between thrips control and yield was demonstrated in either year. The mode of action on the thrips of insecticides applied to the soil is not clear, but is probably of a fumigant nature and related to volatility.

Bissell (T. L.) & Ditman (L. P.). **Experiments on Equipment and Materials for spraying Alfalfa for Insects.**—*J. econ. Ent.* **49** no. 5 pp. 636–638, 1 ref. Menasha, Wis., 1956.

In tests on the control of *Macrosiphum pisum* (Harris), *Philaenus leucophthalmus* (L.) and *Hypera postica* (Gylh.) on lucerne in Maryland, emulsion sprays affording 0·25 lb. heptachlor per acre were applied in 1954 with booms of the sweep type with flat nozzles, such as are usually used for weed and insect control, or of a broadcast type used for the control of Aphids on peas, with hollow-cone or flat nozzles, and others affording 0·25 lb. γ BHC per acre with almost identical apparatus, but omitting the hollow-cone nozzles, in 1955. Pressures of 40 and 100 lb. per sq. in. and spray rates of 10–50 U.S. gals. per acre were used.

Only the broadcast boom, which is designed to spray the plants from two sides, used to apply 50 U.S. gals. spray per acre, reduced the population of *M. pisum* significantly in 1954, and one of the same design gave the greatest reduction in 1955. There were no significant differences between booms or nozzles against the nymphs of *P. leucophthalmus* and adults and larvae of *H. postica*, but a reduction of spray pressure from 100 to 40 lb. per sq. in. and a reduction of volume from 25 to 12·5 U.S. gals. per acre reduced the effectiveness of treatments against both this weevil and *M. pisum*. BHC was more effective than heptachlor against *P. leucophthalmus* in one test in 1954, and both BHC and 1·5 U.S. pints 55 per cent. malathion emulsion concentrate were effective against the Aphid when applied with the sweep-type boom in 25 U.S. gals. spray per acre in 1955, whereas 1·6 U.S. pints 23 per cent. heptachlor and 1·3 U.S. pints 16 per cent. dieldrin emulsion concentrates were not. All but malathion were effective against larvae of *H. postica*, and heptachlor and dieldrin appeared to be better than BHC and malathion against the adults, though the differences were not significant.

Wylie (W. D.). **Determination of Insecticide Residues in Soil by using *Drosophila*.**—*J. econ. Ent.* **49** no. 5 pp. 638–640, 3 refs. Menasha, Wis., 1956.

Tests are described in which the quantities of insecticide that might be used in ten years in a spray programme on peach in Arkansas were applied as wettable powders to typical soils in two peach-growing areas and disked in and the amounts remaining in soil samples 4½ years later determined by bioassay with day-old adults of *Drosophila melanogaster* Mg. Soil obtained from samples taken to a depth of six inches in the plots was mixed and sieved; 5 gm. air-dried soil was wetted with 2 ml. 25 per cent. white Karo solution and spread to a height of about 2·5 ins. up the sides of a vial, and a known number of flies was introduced. Four such vials were prepared for each insecticide. The use of the solution made it

possible to keep the flies alive on untreated soil for at least a week; those exposed to soil moistened with water died of starvation relatively soon. Comparison of mortalities in the vials and in a standard set containing small known amounts of the test insecticides in soil showed that treatment with 15, 15·6, 15·6, 62·5 and 65 parts per million BHC, parathion, dieldrin, DDT and chlordane resulted in residues of 4·2, 0·52, 1·8, 1·6 and 4·3 p.p.m. in one soil and of 10·2, 0·16, 6, 16 and 4 p.p.m. in the other. The addition of 1 ton hydrated lime per acre reduced the BHC residues to 3 and 4·8 p.p.m., respectively, but the growth of peach trees planted two years after treatment was extremely poor on the BHC plots, whether lime was added or not. The method proved unsatisfactory for lead arsenate and methoxy-DDT (methoxychlor), which were too slow in action. It appeared to show promise for tests of plant material and for analysis of a mixture of fertiliser and insecticide. Details are given of the method by which the flies were reared on canned pumpkin in a wide-mouthed jar and transferred to the test vials.

Woodside (A. M.) & Turner jr. (E. C.). **Control of the Clover Root Borer in Virginia.**—*J. econ. Ent.* **49** no. 5 pp. 640–643, 4 refs. Menasha, Wis., 1956.

In view of complaints that red clover was not maintaining stands long enough to justify its use in rotations in Virginia, surveys were made in Augusta County in 1953 and 1954. The results showed that 40–98 per cent. of the plants in second-year fields were infested by *Hylastes* (*Hylastinus*) *obscurus* (Marsham), with an average of 3·5 insects per plant, and that practically all plants were infested and many dead by the summer of the third year. Insecticides were tested for control in 1954 and 1955, and the quantities given are those of actual toxicant applied per acre. BHC at 1 lb. γ isomer in dust, spray and granular formulations, aldrin, dieldrin and heptachlor at 1 lb. in sprays and granules and isodrin and endrin at 1 lb. and chlordane at 5 lb. in granules all gave good control when applied during the first half of April to year-old clover stands and were better than 1·25 lb. methoxy-DDT (methoxychlor) and 5 lb. malathion or toxaphene in granules. When applied to first-year clover in October, BHC in all forms gave excellent control of *H. obscurus* the following year, reduced damage by *Sitona hispidulus* (F.) and, in granular and spray form but not as a dust, controlled the meadow spittlebug [*Philaenus leucophthalmus* (L.)]. It was also effective against *Hylastes* when applied in March, late April and early May. Heptachlor in granules was more effective in March than in October or April. Yields from treated plots showed a close correlation with *Hylastes* control.

Johansen (C.). **Chemical Structure and insecticidal Activity of a Number of systemic Insecticides.**—*J. econ. Ent.* **49** no. 5 pp. 645–652, 9 figs., 17 refs. Menasha, Wis., 1956.

Three series of phosphorothioates and one of pyrophosphates were compared in a study of the effect of structural changes on contact and systemic toxicity to an Aphid (*Macrosiphum sanborni* Gill.). The phosphorothioates were formulated with a polyethylene-glycol-ether emulsifier to give a w/v concentration equal to that of commercial 32·1 per cent. demeton (O,O-diethyl O-ethylthioethyl phosphorothioate), which was used as a standard, and the pyrophosphates were dissolved directly in water. To test contact effects, the Aphids were sprayed on a moving belt at the rate of 0·6 mg. spray per sq. cm., transferred to dishes containing fresh chrysanthemum

leaves, and examined for mortality after 24 hours, and to test systemic effects, chrysanthemum plants in pots were arranged in an apparatus that prevented any fumigant action from treated soil and were infested with Aphids, the insecticides were poured into the pots, and mortality counts were made after six days. The data obtained were plotted as log. dosage against probit mortality, and the results are shown in tables and graphs.

The results with compounds of the first group indicated that phosphorothioates containing a P-Se-C linkage (O,O-diethyl Se-ethyl- and O,O-diethyl Se-methylthioethyl phosphoroselenothioate) had greater contact and systemic action than either of the corresponding P-O-C analogues (demeton and O,O-diethyl O-methylthioethyl phosphorothioate) [*cf. R.A.E.*, A **40** 327]. Contact effect was greater for ethyl than for methyl compounds. Those with the other phosphorothioates showed that effectiveness was reduced by increasing the length of the chain beyond two carbon atoms on either side of the sulphur linkage in demeton, the reduction in contact action being about the same for the O-ethylthio-n-propyl, -isopropyl and -n-butyl homologues as for the O-n-butylthioethyl and O-n-hexylthioethyl homologues, but the reduction in systemic effect was in general greater for the former. The isopropyl group caused less reduction than the n-propyl or higher alkyl groups, and a methyl group beyond the sulphur linkage tended to be less effective by contact but more effective systemically than an ethyl group.

The pyrophosphates tested were TEPP (tetraethyl pyrophosphate) and the five compounds resulting from progressive replacement of the four ethoxy groups in it by dimethylamido groups, complete substitution resulting in the formation of schradan. TEPP was the most effective in contact action but much the least effective, owing to its rapid hydrolysis, in systemic action. Progressive substitution was accompanied by decreases in contact and systemic action, and the symmetrical bis(dimethylamido) compound was less effective than the asymmetrical one. It was also accompanied by reductions in rate of hydrolysis; in spite of their effectiveness in fresh solutions, the dimethylamido and asymmetrical bis(dimethylamido) compounds hydrolysed too rapidly to be of practical use as systemic insecticides.

Clark (E. C.) & Reiner (C. E.). **The possible Use of a Polyhedrosis Virus in the Control of the Great Basin Tent Caterpillar.**—*J. econ. Ent.* **49** no. 5 pp. 653–659, 3 figs., 16 refs. Menasha, Wis., 1956.

In view of the promising control of *Malacosoma fragile* (Stretch) obtained on bitterbrush (*Purshia tridentata*) in California with sprays of a polyhedrosis virus applied by ground equipment [*cf. R.A.E.*, A **43** 42], the possibility of applying such sprays commercially by aeroplane was tested in 1954–55. Sprays containing 460,000, 690,000 and about seven and eight million polyhedra per ml. applied at 3·7, 6·2, 2·5 and 7·1 U.S. gals. per acre, respectively, from an aeroplane flying at a height of 10–15 ft. over infested bitterbrush on 28th May 1954, about 16 days after hatching began, all resulted in infection of the larvae and high mortality, but there was some delay as compared with 1953 [*cf.* **43** 43], mortality being first observed after 15 days and not becoming widespread until after 32 days. Lower temperatures, a longer incubation period due to lower dosages, and the initial infection of only a few larvae, from which the disease was transmitted to others, may have been responsible for this.

In 1955, the virus was tested under more severe conditions. Sprays containing 0·5 million polyhedra per ml. were applied at 2 U.S. gals. per acre from an aeroplane flying at a height of 150–200 ft. to two 50-acre plots of infested bitterbrush growing beneath pine trees. Light rain fell on the following night, and the effective dosage deposited on the plants

was apparently too low to induce an epizootic, no disease being detected during the ensuing five weeks.

Technical problems encountered in the control of *M. fragile* with the virus are discussed in relation to the more general question of the use of the polyhedrosis viruses against insects. The principal difficulty is the procuring of large quantities of the virus, and information is needed on techniques of application so as to ensure the maximum effectiveness of the amounts available. The treatment is not difficult to time, as almost all the damage by *M. fragile* occurs during the last 10–15 days of the larval period, which lasts 60–70 days, and economic infestations can usually be assessed during the preceding year.

CHAMBERLAIN (W. F.). **A simplified quantitative Olfactometer for Use with agriculturally important Insects.**—*J. econ. Ent.* **49** no. 5 pp. 659–663, 2 figs., 8 refs. Menasha, Wis., 1956.

A detailed description is given of modifications of an olfactometer already in use [*cf. R.A.E.*, B **27** 166] that increase its suitability for testing repellents against agriculturally important insects. The modifications reduce the cost of the apparatus and ensure that all the test insects are subjected to an odour gradient; they are introduced into a shallow cage, with the top and bottom of wire mesh, which rests on a partition that divides the lower part of the olfactometer into two parts. The two streams of air to be compared are introduced into these and pass up through the cage, so that the insects are enabled to choose one or the other. Any desired dilution of the odour can be obtained, and the apparatus can be adjusted to determine the effect of a continuous flow of air over surfaces treated with a repellent, thus simulating field conditions, or to compare one chemical with another.

Tests were carried out with turpentine products or fractions, dimethyl phthalate, amyl acetate and diethyl toluamide against seven species, and the results obtained with nymphs of *Melanoplus femur-rubrum* (Deg.) and adults of *Heliothis zea* (Boddie) and *Thyanta custator* (F.) are given in detail. In general, the compounds that were the most volatile were the most repellent, and a reduction in the amount of chemical in the air reduced but did not materially change the order of repellency of the compounds. *Melanoplus* was slightly more and *Thyanta* much less sensitive than *Heliothis*, and dimethyl phthalate, a well known mosquito repellent, gave very poor results with the first two. Amyl acetate, α-pinene and mixtures containing dipentene were among the most repellent materials to all three insects.

BECKER (W. B.), ABBOTT (H. G.) & RICH (J. H.). **Effect of Lindane Emulsion Sprays on the Insect Invasion of White Pine Sawlogs and the Grade Yield of the resulting Lumber.**—*J. econ. Ent.* **49** no. 5 pp. 664–666, 2 refs. Menasha, Wis., 1956.

In further experiments in Massachusetts on the protection of unseasoned pine logs from wood-boring beetles [*cf. R.A.E.*, A **44** 119], sawlogs cut from *Pinus strobus* in March 1953 were sprayed once on 8th April and stored out of doors until autumn in a sunny field surrounded by pine plantations. The bark was examined periodically during the summer and removed from the logs in October, after which insect damage at the wood surface was assessed. The logs were then sawn into boards and graded. A γ BHC emulsion concentrate, diluted with water to contain 0·4 and 0·2 per cent. γ isomer and applied thoroughly to the entire surface of dry logs (approximately 4·75 fl. oz. spray per sq. ft.) gave 87·2–100 per cent. protection against damage

by borers of all types [*cf. loc. cit.*] throughout the summer. At 0·1 per cent., it gave 85·1–99·3 per cent. protection against all but an ambrosia beetle, *Gnathotrichus materiarius* (Fitch), against which it apparently failed. The three treatments resulted in the downgrading of 6·1, 5·3 and 8·9 per cent. of the sawn wood, as compared with 81·4 per cent. after no treatment; this was attributed chiefly to large holes made by round-headed borers (Longicorns) and possibly some flat-headed borers (Buprestids); the effect of the small holes made by the ambrosia beetle was not significant.

Brown (B. E.) & Brown (A. W. A.). **The Effects of insecticidal Poisoning on the Level of Cytochrome Oxidase in the American Cockroach.**—*J. econ. Ent.* **49** no. 5 pp. 675–679, 1 fig., 14 refs. Menasha, Wis., 1956.

As it had been shown that DDT and many other insecticides affect the cytochrome oxidase of tissue from *Periplaneta americana* (L.) [*R.A.E.*, A **43** 305], lethal doses of DDT, methoxy-DDT (methoxychlor), parathion, malathion and a thiocyanate (β-butoxy β′-thiocyanodiethyl ether) were injected as solutions in maize oil into the haemolymph of adult males of the cockroach 2–4 weeks after the final moult to ascertain whether they had any *in vivo* effects on the enzyme. Death usually occurred within 24 hours or very soon after. For the first eight hours after injection of DDT, the cockroaches passed through the typical stages of DDT poisoning without any significant change occurring in the level of the cytochrome oxidase. The cytochrome-oxidase activity in the coxal muscles of cockroaches treated with all the insecticides decreased slightly in 24 hours, but the decrease was not significant with parathion or methoxy-DDT and only with the thiocyanate was it significantly greater than that in cockroaches killed electrically. Malathion and the thiocyanate caused post-mortem reductions 24–48 hours after injection, but the other insecticides did not. It is concluded that DDT does not affect the activity *in vivo* of the cytochrome oxidase of *P. americana*. The cause of the inhibition of cytochrome oxidase by DDT *in vitro* is discussed with reference to the literature, and it is concluded that non-specific adsorption is responsible. Cytochrome oxidase was shown to increase markedly in males of *P. americana* but not in females, after the final moult.

Carlson (E. C.). *Lygus* **Bug Injury and Control on Carrot Seed in northern California.**—*J. econ. Ent.* **49** no. 5 pp. 689–696, 6 figs., 21 refs. Menasha, Wis., 1956.

Investigations were carried out in the Davis area of California in 1954–55 on the injury to carrot seed by *Lygus hesperus* Knight and its control. Two generations of this Mirid developed on carrot during the season, nymphs and adults of the first being most numerous in mid-June and early July, respectively, and nymphs of the second in mid-July; the life-cycle of the second generation lasted 27–35 days. In field-cage tests, feeding by the bugs during the flowering period and after petal-fall resulted in empty and in embryoless seeds, respectively. One adult or nymph per seed head reduced germination from about 90 to about 65 per cent. and caused seed losses of 44–62 per cent. by feeding during the flowering period; seed losses were about half as much after petal-fall. Reduction in germination is more troublesome when caused after petal-fall, as the embryoless seeds cannot be distinguished from sound ones. One adult per two seed heads caused minor economic damage, and nymphs were about twice as injurious; control measures are necessary when the numbers reach this level.

Field-plot tests showed that the first insecticide application should be made as soon as 25–50 per cent. of the flowers on the umbels of the second order are in bloom, when the bugs are beginning to cause economic injury. Comparison of 1–3 applications of 10 per cent. DDT dust in field plots showed that three applications, early in the flowering period of the umbels of the second, third and fourth orders, resulted in satisfactory control until the seed matured, with a significant increase in yield from the first and third orders of umbels, larger seed and a consistently high and significant increase in germination. One application did not give satisfactory control, and two resulted in fair control with less significant increases in yield, size of seed and germination than three. Two applications of 10 per cent. toxaphene dust were inferior to one of 10 per cent. DDT. Predators of the genera *Nabis* and *Geocoris* were reduced by DDT to about the same extent and for the same period as *Lygus*, but *Orius* sp., which attacks mites, proved fairly tolerant of it.

Walker (R. L.) & Hopkins (A. R.). **Studies on the Control of Boll Weevils in Surface Woods Trash.**—*J. econ. Ent.* **49** no. 5 pp. 696–698, 1 fig., 2 refs. Menasha, Wis., 1956.

In the south-eastern United States, *Anthonomus grandis* Boh. commonly hibernates in surface débris in woods, mainly within 50 ft. of the perimeter [*cf. R.A.E.*, A **31** 188], and investigations were carried out in South Carolina in 1954–55 on the control of the overwintering adults by means of granular insecticides. In 1954, wooded areas were treated to a depth of 200 ft. from the edge with heptachlor, toxaphene, chlordane or dieldrin at 4 lb. per acre, applied by aeroplane in March, and examination of samples of débris taken from the woods in January–February and in April showed the presence of 968, 1,694 and 2,904 living weevils before and none after treatment with the first three materials and of 564 before and 387 after treatment with dieldrin, a reduction of 31 per cent., whereas there was a natural mortality of 40 per cent. in untreated woods. Cotton fields in the treated area were examined for weevils on 5th, 11th and 20th May, and 17, 15 and 21 were found per acre, as compared with 102, 83 and 26 in similar fields in an untreated area.

In a further test, 500 field-collected weevils were put in each of a number of cages over débris at the edge of a wooded area in October 1954, and granules were applied uniformly to the surface of the débris by means of a salt shaker on 1st March 1955. Counts of the weevils that appeared between 1st March and 24th June showed percentage emergences of 6 and 3·4 for treatment with 2·5 and 5 lb. dieldrin per acre in 10 per cent. granules, 0·8 and 0·4 per cent. for 5 and 10 lb. γ BHC in 5 per cent. granules, and 15·4 per cent. for no treatment, indicating net kills of 61, 77·9, 94·8 and 97·4 per cent. for the four insecticide treatments. The difference between the BHC treatments was not significant, but the other differences were highly significant.

Burke (H. B.) & Martin (D. F.). **The Biology of three Chrysopid Predators of the Cotton Aphid.**—*J. econ. Ent.* **49** no. 5 pp. 698–700, 2 refs. Menasha, Wis., 1956.

Chrysopa rufilabris Burm., *C. plorabunda* Fitch and *C. oculata* Say were observed in fields of cotton infested by *Aphis gossypii* Glov. near College Station, Texas, in the summer and autumn of 1954, and laboratory and field investigations on their bionomics were begun in August of that year.

C. rufilabris, which was the principal species, was present on cotton in August and September; adults and larvae were collected on *Sorghum halepense* in October and November, and adults but no immature stages on lucerne in December and January. Females taken at light in early February deposited a few eggs, and eggs and larvae were found on oak in early March. *C. plorabunda* was found on *S. halepense* and weeds after it decreased on cotton; adults were abundant on lucerne throughout the winter, but larvae were observed in November and then not again until March. Larvae and adults of *C. oculata*, which was the least abundant, were collected in November on plants other than cotton and then not again until March. Laboratory tests showed that the larvae of this species pupated in the soil, and laboratory-reared third-instar larvae that were caged out of doors on 23rd December constructed cocoons about three inches below the surface by the end of the month; about half died in the prepupal stage, and the remainder pupated in mid-February, one adult emerging on 27th February. It is concluded that *C. oculata* overwinters in the prepupal stage in the soil.

In the laboratory, the egg, larval, prepupal and pupal stages of *C. rufilabris* averaged nearly 4, 8, 3 and 7 days, respectively, those of *C. plorabunda* about 5, 10, 4 and 8 days, and those of *C. oculata* about 5, 10, 6 and 11 days. Males and females of the three species lived for averages of 23·5 and 23·6, 34·6 and 62·5, and 26·4 and 22·9 days, respectively, and the average numbers of eggs deposited per female were 31·2, 32 and 185·4. Larvae of all three species fed voraciously on *A. gossypii* in the laboratory, consuming average numbers of 268·8, 208 and 265·6, respectively, during life. The adults of *C. oculata*, but not of the others, also attacked the Aphid, one devouring as many as 453 in ten days.

Middlekauff (W. W.). **A Cimbicid Sawfly feeding on an ornamental Honeysuckle.**—*J. econ. Ent.* **49** no. 5 p. 701, 2 figs., 1 ref. Menasha, Wis., 1956.

Larvae of a species of *Zaraea*, later identified as *Z. americana* Cress., were found feeding at night on a hedge of honeysuckle (*Lonicera nitida*) in southern California in 1955; they did not cause sufficient damage to merit control measures. In the laboratory, they readily fed on *L. nitida* and *L. japonica* and formed cocoons on the side of the cage between 14th and 22nd June. These were left out of doors, and females of the sawfly emerged on 20th March 1956.

Chamberlain (W. F.). **An improved Ethyl Acetate Jar for Trap Light Collecting.**—*J. econ. Ent.* **49** no. 5 p. 702. Menasha, Wis., 1956.

Ethyl acetate, the vapour of which kills insects rapidly, is commonly used to saturate a layer of plaster of paris at the bottom of the collecting bottles of small light-traps, but when large numbers of insects are caught, it does not inactivate the top layer quickly enough to prevent the beetles from crawling over the moths and damaging them. The author describes an improved form of jar, in which the plaster is deposited on the sides as well as the bottom. With it, large numbers of moths and beetles have been collected without damage to the moths, apparently because the vapour is maintained at a high concentration at the top of the layer of insects. Ethyl acetate should be added each day, and the bottle should be dried in an oven if moisture collects on the plaster; this is usually necessary only once in 30–60 days, and should be done only twice altogether, after which the dirt

and oils that have collected usually reduce the inactivating effect of the fumigant.

Clark (E. C.) & Reiner (C. E.). **The Availability of certain proprietary Adjuvants for Use with the Polyhedrosis Viruses of Insects.**—*J. econ. Ent.* **49** no. 5 pp. 703–704, 3 refs. Menasha, Wis., 1956.

As little has been done to ascertain the best adjuvants for use in sprays containing bacteria or viruses, methyl cellulose (methocel), diesel oil, five non-ionic surface-active agents, and combinations of the last with diesel oil were tested for compatibility with the polyhedrosis virus of *Colias eurytheme* Boisd. in California [*cf. R.A.E.*, A **40** 62]. A water suspension of polyhedra was added to a 1 per cent. aqueous solution of each proprietary material and allowed to stand for several months at room temperature, after which it was applied to sprigs of lucerne with an atomiser. When diesel oil was tested, the polyhedra were added to the oil, removed from it after standing and resuspended in distilled water before being applied to the lucerne, as treatment with the oil made the foliage unpalatable to the insects; diesel oil was also tested with dried polyhedra. The combinations of adjuvants and oil were tested in the same manner as oil alone.

When larvae of *C. eurytheme* were allowed to feed on the treated lucerne, on lucerne treated similarly but without the virus and on untreated lucerne, mortality counts showed that none of the treatments had any adverse effect on the virus occluded within the polyhedra. It is not known whether any of the agents would give good results in the field, but all appear suitable for testing.

Klostermeyer (E. C.) & Rasmussen (W.). **A Counting Plate for sampling Mite Populations.**—*J. econ. Ent.* **49** no. 5 pp. 705–706, 1 fig., 3 refs. Menasha, Wis., 1956.

Counts of mites deposited on sticky glass plates by brushing machines are facilitated by division of the plates into equal areas [*cf. R.A.E.*, A **45** 149], but as changes of population between treatments are more important than absolute populations, any aliquot giving a rapid valid estimate of the total population would be satisfactory. In work in Washington, the plate is put on a counting board having two strips crossing at right angles in the centre and comprising 10 per cent. of its area. The counting board is slipped along the microscope stage while the mites over one strip are counted, and then rotated for counting on the other. This technique proved satisfactory over four years, and the labour saved permitted the taking of a larger sample of leaves, more frequent sampling and the use of a larger number of plots than would otherwise have been possible. The brushing machine can also be used for sampling populations of sedentary, leaf-feeding insects.

Investigations on the two-spotted spider mite [*Tetranychus telarius* (L.)] on lucerne showed that sampling with the brushing machine was slow, required large numbers of leaves, and did not reveal the presence of predacious mites, as did sweeping with a net. Samples are therefore taken by sweeping, usually 20 times per plot, anaesthetising the collected insects and mites, separating the latter by a shaker device provided with a screen, and keeping them in cold storage until needed. They are then shaken over the revolving brushes of the brushing machine and so deposited on the sticky plate and counted in the usual manner.

Davis (J. W.), Cowan jr. (C. B.) & Parencia jr. (C. R.). **Control of the Cotton Aphid and Cotton Leafworm with Phosphorus Insecticides.**— *J. econ. Ent.* **49** no. 5 pp. 706–707. Menasha, Wis., 1956.

An account is given of investigations, carried out mainly in the autumn of 1955, on the control of heavy infestations of *Aphis gossypii* Glov. and *Alabama argillacea* (Hb.) on cotton in central Texas. Aphid counts made 1–16 days after the application of 7·5 U.S. gals. spray per acre on 9th August showed that 0·25 lb. demeton [diethyl 2-(ethylthio)ethyl phosphorothioate], 0·75 lb. malathion and 0·375 lb. Shell OS-2046 [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate] and 0·25 and 0·375 lb. Bayer 17147 [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] per acre caused great reductions in Aphid numbers, with no significant difference between them, though the last material caused the least reduction on the first day; 0·25 lb. Bayer 17147, Shell OS-2046 and parathion applied in 6 U.S. gals. spray per acre on 6th September were just as effective, parathion permitting slightly less reinfestation than the others after two weeks.

When applied in 6 U.S. gals. spray per acre on 16th August 1954, 0·3, 0·375 and 3 lb. endrin, Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] and toxaphene, respectively, and 0·25 lb. malathion, parathion and methyl-parathion gave complete control of *Alabama* 1–2 days after treatment. In 7·5 U.S. gals. spray per acre applied on 16th September 1955, 0·25 lb. malathion, Shell OS-2046 and parathion and 0·25 and 0·375 lb. Bayer 17147 gave complete control in one day, but the first two permitted some reinfestation after a week and populations greater than the original ones after two, and in 7·5 U.S. gals. per acre applied on 22nd September, 0·25 lb. Bayer 17147 and Chlorthion, 0·5 lb. Bayer L 13/59 [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] and 2·25 lb. toxaphene and Strobane [a wettable powder containing a chlorinated mixture of α-pinene isomers with a chlorine content of approximately 66 per cent.] gave 100, 73, 89, 82 and 64 per cent. control in 44 hours.

Mason (H. C.). **Tests with Bait Sprays for the Control of** *Drosophila*.— *J. econ. Ent.* **49** no. 5 pp. 708–709, 1 fig., 2 refs. Menasha, Wis., 1956.

Field-cage tests with bait-sprays for the control of species of *Drosophila*, mainly *D. melanogaster* Mg., on tomatos for canning were carried out in Maryland in 1954. Single plants in a heavily infested planting were covered with cages on 13th September, and small boxes of rejected tomatos were sprayed to run-off with a fresh mixture of 10 per cent. molasses, 1 per cent. cider vinegar (acid content 5 per cent.), 0·1 per cent. yeast and 0·1 per cent. insecticide in water and placed on the ground in the cages within an hour on 14th and 29th September, the first boxes being removed when the second were put in. Each cage was artificially infested with an additional 200 laboratory-reared adults of *D. melanogaster* on 14th, 22nd and 29th September, and three tomatos with fresh slits about 1·5 ins. long were left in each cage for about 16·5 hours on 16th, 20th and 27th September and 1st and 6th October. Heptachlor, aldrin and Bayer L 13/59 [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] caused significant reductions in the numbers of eggs laid in the slit fruits on the first two but not the third date following the first application and on both dates following the second, and gave more than 94 per cent. reduction on 1st October; malathion did not differ significantly from them, though it appeared rather less effective, until

the last date, when it was significantly inferior to the other materials but significantly superior to no treatment. Heavy rain might have caused less promising results.

Ball (H. J.). **Corn Rootworm Control for surface-planted and listed Corn.**—*J. econ. Ent.* **49** no. 5 pp. 709–710, 1 ref. Menasha, Wis., 1956.

As preliminary spraying of the soil has sometimes given less control of *Diabrotica longicornis* (Say), *D. virgifera* Lec. and *D. undecimpunctata howardi* Barber on maize sown in furrows than on surface-sown maize in Nebraska, investigations were carried out in 1954 on the effect of aldrin, BHC and heptachlor in sprays at 0·5 lb. per acre on the numbers of larvae and pupae within a circle 12 ins. in diameter round plants of maize sown by the two methods. All three insecticides caused highly significant reductions in population on surface-sown maize, but non-significant ones on that in furrows, though the numbers were significantly higher in the listed than in surface-sown plots only after treatment with BHC. This and heptachlor significantly reduced lodging of the stalks, measured immediately before harvest and all treatments were followed by increased yields, though the increases were not significant, with no significant differences in effect between the two methods of sowing.

Gojmerac (W. L.). **Effects of Insecticides on Germination and Emergence of Sugar Beets under Greenhouse Conditions.**—*J. econ. Ent.* **49** no. 5 pp. 710–711, 1 ref. Menasha, Wis., 1956.

Insecticides mixed with fertiliser gave effective control of *Tetanops myopaeformis* (Röder) on sugar-beet in North Dakota in 1955, but caused a slight reduction in the stand of seedlings [*cf. R.A.E.*, A **45** 223]. This disappeared at thinning, but might become important under adverse growing conditions, and a series of germination tests was therefore carried out in the greenhouse in the winter of 1955–56. Fertiliser at 100 lb. per acre, insecticide at 1–5 lb., mainly in wettable-powder or granular formulations, and known numbers of broken seed-balls were put in the soil at a depth of 0·25 in., and the percentage of plants that failed to appear was used as an index of phytotoxicity.

There was a wide variation in response, but heptachlor, chlordane, aldrin, dieldrin and methoxy-DDT (methoxychlor) appeared to be very slightly phytotoxic, resulting in an average plant loss of 23 per cent., as compared with 19·8 per cent. for no treatment, but Am. Cyanamid 3911 [O,O-diethyl S-ethylthiomethyl phosphorodithioate], Dow ET-14 [O,O-dimethyl O-2,4,5-trichlorophenyl phosphorothioate], Dow ET-15 [O-methyl O-2,4,5-trichlorophenyl phosphoramidothioate] and malathion were more injurious (46 per cent. loss of plants) and the first two resulted in stunted plants and curled leaves, respectively. Hercules AC 528 [2,3-p-dioxandithiol S,S-bis(O,O-diethyl phosphorodithioate)], however, appeared to stimulate both germination (18·6 per cent. loss of plants) and growth.

Ringel (S. J.) & Gooden (E. L.). **Storage Tests of Water-dispersible Insecticide Powders at Temperatures from −50 to +55°C.**—*J. econ. Ent.* **49** no. 5 pp. 711–712. Menasha, Wis., 1956.

Water-dispersible powders containing DDT or dieldrin were stored at controlled temperatures of 55, 10, −12 and −50°C. [131, 50, 10·4 and

−58°F.] and high and low humidities for a year, and similar powders containing DDT, dieldrin and γ BHC (lindane) in a hot and a cold climate in the field for rather longer, and they were then tested for dispersibility and particle size. It is concluded from the results that with water-dispersible powders of these insecticides formulated to standards for ordinary use, there are no serious storage hazards from rigorous climatic conditions except at high temperatures, and that at such temperatures high humidity is an additional hazard.

Wene (G. P.). *Tetranychus marianae* **McG., a new Pest of Tomatoes.**—*J. econ. Ent.* **49** no. 5 p. 712, 1 ref. Menasha, Wis., 1956.

Tetranychus marianae McG. was found for the first time on tomato in the Lower Rio Grande Valley of Texas in May 1956, when heavy infestation killed plants in many fields. The damage caused to the leaves and a migration of the mites from a field of severely damaged tomatos across the ground to a field of cotton 30 ft. away are described.

Pfrimmer (T. R.) & Gaines (R. C.). **Field Tests with new Materials against Cotton Insects at Tallulah, Louisiana during 1955.**—*J. econ. Ent.* **49** no. 5 pp. 712–713. Menasha, Wis., 1956.

Several new organic insecticides were tested on cotton in Louisiana in 1955 for the control of *Anthonomus grandis* Boh., which was much the most important insect present, *Heliothis zea* (Boddie), which did not become abundant until after mid-August, *Aphis gossypii* Glov., which had become very numerous in some plots by that time, and spider mites, which were unimportant.

In sprays applied 12 times between 13th July and 7th September, Bayer 17147 [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate], at an average rate of 0·5 lb. per acre, resulted in significantly lower infestation by *Anthonomus* than any other treatment, and 1 lb. Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate], 0·9 lb. Bayer L 13/59 [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] and 4·1 lb. Strobane [a wettable powder containing a chlorinated mixture of α-pinene isomers with a chlorine content of approximately 66 per cent.] significantly reduced it as compared with no treatment, but 4·1 lb. toxaphene was ineffective. Strobane resulted in a significantly lower percentage of bolls injured by *H. zea* than did Chlorthion, Bayer L 13/59 or no treatment, and all treatments reduced the Aphid population, Chlorthion significantly more than toxaphene or Strobane, and Bayer L 13/59 more than toxaphene. Strobane and toxaphene resulted in significantly higher yields than any other treatment, and Bayer 17147 and Chlorthion in significantly higher yields than Bayer L 13/59, but not higher than no treatment. Bayer L 13/59 was applied as a soluble powder and all other materials as emulsion concentrates, and three of the applications were washed off by rain within six hours.

As dusts, applied at 16–19 lb. per acre 13 times between 13th July and 7th September, 2·5 and 5 per cent. Bayer 17147 gave significantly better control of *Anthonomus* than any other treatment, 2 per cent. endrin, alone or with sulphur, gave significantly better control than 2·5 per cent. DDVP [dimethyl 2,2-dichlorovinyl phosphate], alone or with Aroclor (a chlorinated polyphenyl) and than 5 or 10 per cent. Bayer L 13/59; all treatments reduced the Aphid infestation, none had any significant effect on injury by *Heliothis*, and all but endrin alone significantly reduced mite populations. Bayer 17147 and the endrin dusts resulted in significantly higher yields

than any other treatment, and Bayer L 13/59 at 5 per cent. in a significantly higher one than no treatment. Three of the applications were washed off by rain within 12 hours.

In sprays applied 12 times between 25th July and 19th September, averages of 0·7 lb. actual DDVP per acre, alone or with Aroclor, 0·7 lb. Bayer L 13/59 in two soluble-powder formulations, and 0·2 lb. dieldrin gave no control of *Anthonomus* or *Heliothis* and had no effect on yield. All treatments but dieldrin reduced the Aphid population, and mites were not present. DDVP and dieldrin were in emulsion concentrates; one application was washed off by rain within six hours. Three applications of a little over 2 lb. technical Am. Cyanamid 3911 [O,O-diethyl S-ethylthiomethyl phosphorodithioate] per acre in sprays gave some control of *Anthonomus* and prevented an increase in the Aphid, but did not increase the yield.

Richardson (H. H.) & Roth (H.). **Ethylene Dibromide Fumigation of Mangoes infested with the West Indian Fruit Fly at Temperatures near 55°F.**—*J. econ. Ent.* **49** no. 5 pp. 715–717, 1 fig., 6 refs. Menasha, Wis., 1956.

Fumigation with ethylene dibromide has given satisfactory control of fruit-flies in mangos at temperatures of about 70°F. [*cf. R.A.E.*, A **43** 320], but as mangos from the West Indies arrive at New York under quarantine at temperatures of about 50°F., small-scale tests were made in New Jersey in 1955 on the effect of fumigation when the temperature of both air and fruit was 52–55° [*cf.* **40** 352]. In fumigation drums with a capacity of 55 U.S. gals., exposure to a dosage of 2 oz. per 1,000 cu. ft. for two hours, with fan circulation for the first 15–20 minutes, gave complete control of *Anastrepha mombinpraeoptans* Sein in mangos occupying about 25 per cent. of the space, and the fruit showed no change in flavour or quality.

In tests on a practical scale at about 55°F. in 1956, with mangos packed in crates, effective dosages varied from 4 oz. per 1,000 cu. ft. in a chamber with a capacity of 50 cu. ft. of which 25 per cent. was occupied by the load, to 12 oz. per 1,000 cu. ft. in one of 2,600 cu. ft. with a 40–45 per cent. load.

Johnson (W. T.). **The Asiatic Oak Weevil and other Insects causing Damage to Chestnut Foliage in Maryland.**—*J. econ. Ent.* **49** no. 5 pp. 717–718, 3 refs. Menasha, Wis., 1956.

The growing of chestnuts for seed or consumption is increasing in the eastern and south-eastern United States, but some orchards have had to be abandoned because of infestation by insects and other pests. In Maryland, the most important of those that feed on the leaves is *Cyrtepistomus castaneus* (Roel.), which causes serious damage in nurseries and orchards and has increased greatly since it was first reported in the State in September 1949 [*cf. R.A.E.*, A **44** 166]. Adults of this weevil attack young saplings and branches near the ground in early August, increase in numbers as the season progresses and cause obvious damage to the topmost branches by mid-September. Defoliation may reach 35 per cent., and there is also considerable feeding on the green burs, 6–12 weevils sometimes feeding or hiding between the spines of each in unsprayed orchards. The adults are readily killed by sprays of wettable DDT and by oil fogs containing DDT or lindane [γ BHC], but reinfestation is rapid if other food-plants are near. Adults of *Popillia japonica* Newm. sometimes cause extensive damage and

require control, but this insect is now rarely important in Maryland, except in nurseries. The leaves are injured in spring by *Mnemonica auricyania* (Wlsm.), a Micropterygid that is increasing in importance in chestnut orchards. The eggs are laid in mid-April in the leaves and hatch in about ten days. The larvae mine in the leaves for about ten days, destroying the entire parenchyma, drop to the ground and form cocoons a few inches below the surface. The adults emerge in early April. Other insects that damage the foliage, including *Nematocampa limbata* (Haw.) and *Longistigma caryae* (Harris), are of little importance.

Two Tetranychids occur on chestnut in Maryland. *Eotetranychus hicoriae* (McG.) has been reported to cause sporadic damage, but *Oligonychus bicolor* (Banks) was the more important in 1954–56. It occurs in large numbers and feeds on the upper surfaces of the leaves, causing discoloration along the veins, and on the bark of young twigs. The eggs are deposited along the leaf veins. It is readily controlled by sprays of nicotine sulphate, parathion, Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] or malathion.

Shiller (I.) & Chapman (A. J.). **Chemical Control of Pink Bollworms overwintering in the Soil.**—*J. econ. Ent.* **49** no. 5 pp. 718–719. Menasha, Wis., 1956.

In tests in Texas in 1944 and 1953–55 on the possibility of reducing the survival of larvae of *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) overwintering in cotton bolls left in the field, weighed quantities of open infested bolls were buried in the soil under cages equipped with traps, and the effectiveness of different insecticide treatments was based on emergence records from treated and untreated lots.

In 1944, the bolls were buried at depths of 2, 4 and 6 ins. and a 1:1 emulsion of D-D [a proprietary mixture of 1,3-dichloropropene and 1,2-dichloropropane] and water was poured into furrows 1·5 ins. deep and immediately covered with soil. Treatment with the emulsion at rates of 25·5, 51 and 102 U.S. gals. per acre reduced emergence by 42·4, 82·6 and 89·1 per cent., respectively, as compared with no treatment.

In 1953–54, the bolls were first sprayed with emulsions at a rate equivalent to 25 U.S. gals. per acre and then buried 2 ins. deep, and it was found that 6 lb. γ BHC, 8 lb. endrin and 10 lb. parathion, aldrin or heptachlor per acre reduced emergence by 90–97 per cent.; in 1954–55, similar treatment with these materials, except that heptachlor was used at 20 lb., and with 8 lb. γ BHC and 10 lb. isodrin reduced it by 65·4–90·7 per cent. Treatment in one or other year with 10 lb. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] or dieldrin, 16 lb. EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate], 2–16 lb. Bayer L 13/59 [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate], 20 lb. Strobane [a wettable powder containing a chlorinated mixture of α-pinene isomers with a chlorine content of approximately 66 per cent.] or DDT and 21 lb. chlordane per acre caused lower but significant reductions, and 15 lb. malathion, 10 lb. Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] or Am. Cyanamid 4124 [O,O-dimethyl O-2-chloro-4-nitrophenyl phosphorothioate] and 30 lb. parathion were ineffective.

Brown (H. E.). **Hessian Fly Control with Systemic Insecticides.**—*FAO Plant Prot. Bull.* **5** no. 10 pp. 149–155, 2 graphs, 5 refs. Rome, 1957.

Preliminary field tests in Missouri indicated that Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)] reduced populations of *Mayetiola*

(*Phytophaga*) *destructor* (Say) on wheat when applied to the seeds or the soil before sowing or when sprayed on the foliage at the time of fly emergence, but greenhouse experiments under conditions of heavy infestation and prolonged exposure showed that it was not persistent enough to protect the seedlings when applied to the seed, and tests were therefore made with Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate (Am. Cyanamid 3911)], which was expected to have a longer residual effect.

In a greenhouse test in 1956, 44 per cent. Thimet on carbon was sprinkled in shallow trenches at the rate of 1·4, 3·5 or 7 lb. actual toxicant per acre and the seeds were sown and covered on 20th March. Fly emergence began on 1st April, and oviposition was heavy by 5th April, with no difference in numbers of eggs on plants in treated and untreated plots. Counts on 20th April showed populations of about 150 and 10 larvae per 100 plants on untreated plots and those receiving the lowest dosage, respectively, and none on those receiving the higher ones.

In a field test in the same year, 44 per cent. Thimet and 50 per cent. Isosystox [O,O-diethyl S-2-(ethylthio)ethyl phosphorothioate (demeton-S)] on carbon were applied at 200, 400, 800 and 1,600 gm. toxicant in 345 lb. fertiliser per acre with the seed at sowing. The fertiliser was specially mixed, with ammonium sulphate as the source of nitrogen, to bring the mixture below pH 7 and prevent any chemical degradation due to an alkaline medium. The wheat was sown on 6th September, and the seedlings appeared between 14th and 18th September. No differences were observed between treated and untreated seedlings, except that the stems of those receiving Thimet at the two highest rates had an abnormal yellow coloration for the first 7–10 days. Heavily infested stubble was distributed on the plots on 15th September to ensure a suitable infestation, and flies were observed in the field from 1st to 12th October. Counts in December showed populations of 62·33, 23·33, 2·83 and 0·33 larvae per 100 plants for the four Thimet treatments, 76·33, 113, 131 and 54·5 for Isosystox, the erratic results for which were probably due to experimental errors, and 138·33 for no treatment; the better protection afforded by Thimet was probably due to its longer residual effect. Forage samples were collected on 12th, 19th and 26th October, 2nd November and 28th December, and the residues obtained on analysis indicated that 0·1–0·5 part per million Thimet would have to be maintained in the plant tissues for satisfactory control of *M. destructor*. Isosystox residues were not determined. Forage yields were higher on all the treated than on the untreated plots, but there was no significant correlation between yield and control of *M. destructor*, so that the increased growth was probably due to incidental control of soil organisms. It is concluded that the materials will protect wheat from *M. destructor* for at least five weeks, thus providing an effective method of field control.

Jourdan (M. L.). **Les punaises du blé** *Aelia germari* **Küst. (Hémiptères Pentatomidae)** *Eurygaster austriaca* **Schrk. (Hémiptères Scutelleridae).**—*Mémento Serv. Déf. Vég. Dir. Agric. Maroc* no. 64, 18 pp., 3 pls., 3 figs. Rabat, 1955. **Wheat Stink Bugs in Morocco.**—*FAO Plant Prot. Bull.* **5** no. 11 pp. 169–171. Rome, 1957.

The first of these papers is a revision of one published in 1935 [*R.A.E.*, A **24** 217] and is largely identical with it. The species previously referred to as *Aelia triticiperda* Pomel has since been found to be *A. germari* Küst., and this and *Eurygaster austriaca* (Schr.) are the most important of the bugs attacking cereals in Morocco, though *Dolycoris numidicus* Horv. was observed on the flowering ears of hard wheat near Midelt in 1947. In connection with the parasites of the bugs [*cf.* **24** 189], it is stated that the

species of *Microphanurus* that attacks the eggs of *A. germari* [*cf.* **23** 293] has been identified as *M. perrisi* (Kieff.). The section on chemical control has been rewritten. In laboratory tests in 1955, with dusts applied at a rate equivalent to 22·5 lb. per acre, parathion gave complete mortality of *E. austriaca* within a day at 0·8 per cent. and of *A. germari* at 0·1 per cent., and methyl-parathion was equally effective at 0·078 and 0·009 per cent., respectively. Dusting with 0·5 per cent. of either material is recommended.

The second paper comprises a brief survey of the bionomics, natural enemies and control of the bugs and of the injury that they cause. The identity of the North African species of *Aelia* is not yet clear, and it is now considered that both *A. germari* and *A. cognata* Fieb. attack wheat in Morocco, the first being more abundant on the plains, and the second in the mountains. The best method of preventing damage is to sow early-maturing varieties and harvest early.

Outbreaks and new Records.—*FAO Plant Prot. Bull.* **5** no. 10 p. 161; no. 11 pp. 176–177. Rome, 1957.

V. Lasaga states (p. 161) that a virus disease of rice similar to the rice stripe that is transmitted by *Delphacodes striatellus* (Fall.) in Japan has been found in Cuba, but that the vector there is unknown.

G. H. Berg reports (p. 176) that as an eradication campaign was to be begun in Costa Rica in July 1957 against *Ceratitis capitata* (Wied.), which is established on the central plateau [*cf. R.A.E.*, A **44** 247], a general survey of the infested area was carried out in late May and early June. This showed that the fruit-fly had not appreciably extended its range in the previous two years. It was present in *Citrus* groves throughout the plateau, and populations were low in large groves as a result of spraying operations, though there was a constant supply of adults from other sources. It was not found in the area between San José and Puntarenas, the seaport to which the fruit is transported, and it was common on coffee, though not on *Citrus*, in the Turrialba region.

Marshall (J.) & Morgan (C. V. G.). **Notes on Limitations of natural Control of phytophagous Insects and Mites in a British Columbia Orchard.**—*Canad. Ent.* **88** no. 1 pp. 1–5, 3 refs. Ottawa, 1956.

Since natural enemies have been shown to afford control of many insect pests in orchards in eastern Canada not treated with insecticides [*cf. R.A.E.*, A **43** 265], the effect of omitting treatments was investigated in a mixed orchard in the semi-arid southern interior of British Columbia. The trees were planted in 1946 and came into bearing in 1951; no sprays were applied except a fungicide on peach, and observations were made each year until 1954, when about half the insects and mites of importance in this part of British Columbia had been recorded in it. On apple, *Cydia* (*Carpocapsa*) *pomonella* (L.) destroyed virtually all the crop, even in seasons unfavourable for it, and *Typhlocyba pomaria* McAtee invariably caused considerable damage to the foliage, which doubtless decreased productivity. Losses of pear crops ranged up to 35 per cent., largely owing to attack by *C. pomonella*, *Psylla pyricola* Först., and Eriophyid mites. In some seasons, *Hyalopterus pruni* (Geoffr.) (*arundinis*, auct.) caused losses of about 25 per cent. of apricots of one variety, but was rather less injurious to two others, and an average loss of 25–35 per cent. of plums. *Myzus cerasi* (F.) consistently caused complete loss of cherry crops. Losses on peach did not exceed 10 per cent. Infestation by orchard mites was generally negligible, though

Metatetranychus ulmi (Koch) was occasionally fairly numerous on the leaves of apple, plum and prune. It is concluded that conditions in the interior of British Columbia require the use of insecticides, and DDT and methoxy-DDT (methoxychlor) are recommended, although either may upset the biological balance.

Hudon (M.). *Dibrachys cavus* (**Wlkr.**) (**Hymenoptera: Pteromalidae**), **a new Parasite of the European Corn Borer,** *Pyrausta nubilalis* (**Hbn.**) (**Lepidoptera: Pyralidae**), **in Canada.**—*Canad. Ent.* **88** no. 1 p. 25, 2 refs. Ottawa, 1956.

In late June 1955, a larva of *Pyrausta nubilalis* (Hb.) dissected from an overwintered maize stalk in Quebec was found to be parasitised by larvae from which adults subsequently identified as *Dibrachys cavus* (Wlk.) were reared. This appears to be the first time that *D. cavus* has been obtained from *P. nubilalis* in Canada.

Monro (H. A. U.) & Upitis (E.). **Selection of Populations of the Granary Weevil** *Sitophilus granarius* **L. more resistant to Methyl Bromide Fumigation.**—*Canad. Ent.* **88** no. 1 pp. 37–40, 2 graphs, 4 refs. Ottawa, 1956.

Investigations were begun in Ontario in 1953 to determine whether significantly different degrees of tolerance to fumigation with methyl bromide would develop in populations of stored-product pests as the result of continuous selection, and this paper contains the preliminary results of tests with *Calandra* (*Sitophilus*) *granaria* (L.). The experiments were carried out with stocks reared continuously in the laboratory from a strain obtained from south-eastern Ontario in 1936 and from parents collected in the holds of cargo ships entering Montreal from overseas in 1950 and at various elevators in western Ontario in 1951. The fumigation equipment enabled the experimental conditions to be reproduced exactly, and it gave uniform results with non-selected control stock over ten generations. The insects were maintained throughout at 25°C. [77°F.] and 70 per cent. relative humidity, and adults of consecutive generations were exposed when 7–14 days old to various concentrations of methyl bromide for five hours at atmospheric pressure. Survivors of treatments giving 75 per cent. mortality or more were used as parents for the next selected generation. At the time of writing, selections from the first two strains differed significantly in resistance from the non-selected stocks, the median lethal doses for the 11th and 14th selected generations, respectively, being approximately twice those for the controls.

Melis (A.). **Ancora il fattore termico causa determinante dell'entità degli sfarfallamenti invernali e primaverili del** *Dacus* **nel 1954–55.** [The thermal Factor again determining the Numbers of *Dacus oleae* emerging in Winter and Spring in 1954–55.]—*Redia* **41** (1956) pp. 1–22, 3 figs., (1 fldg.), 3 fldg. tables, 7 refs. Florence [1957]. (With a Summary in English.)

The detailed results are given of a further year's investigations on the winter and spring emergence of adults of *Dacus oleae* (Gmel.) [*cf. R.A.E.*, A **45** 47, etc.], in the field and laboratory in Tuscany, carried out in 1954–55. In November–December, temperatures rarely fell below freezing point and rainfall was slight. January was exceptionally mild with moderate rainfall,

and February was also mild, though somewhat wetter. March was relatively cold, and rainfall was slight in both March and April.

The techniques employed in previous years [*cf. loc. cit.*] were again adopted. In the laboratory, some 250 pupae and 450 larvae were placed on sand in metal cages or in glass containers on 2nd–10th December 1954, and all the larvae entered the sand to pupate. The percentages that gave rise to adults were 53–71·5 in the cages and 64–88 in the glass containers, and emergence proceeded from 16th January to 3rd March. In general, adults emerged earlier from cages stocked with pupae than from those stocked with larvae.

In the field, 2,175 larvae (of which 2,170 entered the soil) and 800 pupae were caged between 22nd November and 10th December 1954, in three cages in each of five districts. Adults emerged in all the cages in four districts and in one in the fifth, all between 6th February and 30th March. The emergence percentages ranged from 2 to 18·5 and averaged 8·04. Males and females were obtained in about equal numbers. Subsequent examination of the cages showed that many adults had failed to emerge from soil that was hard as a result of little rainfall and drying winds, and temperature and rainfall are held to be the major factors determining successful emergence.

Trap-jars, mostly containing 3 per cent. diammonium phosphate, were placed among the olive trees from November 1954 to October 1955, and adults were taken throughout this period, except between 10th April and 20th June.

Melis (A.). **L'attività antidacica in Toscana litoranea nel 1955.** [The Campaign against *Dacus oleae* on the Coast of Tuscany in 1955.]—*Redia* **41** (1956) pp. 29–74, 5 fldg. tables, 6 refs. Florence [1957]. (With a Summary in English.)

Experiments on the control of *Dacus oleae* (Gmel.) on olives on the coast of Tuscany were continued in 1955. In addition to those already noticed [*R.A.E.*, A **45** 51–53], they included one series of tests in which O,O-dimethyl S-(isopropylcarbamyl)methyl phosphorodithioate and O,O-dimethyl S-(methylcarbamyl)methyl phosphorodithioate were applied at 0·06 per cent. on 17th August and 0·03 per cent. on 10th October in sprays, or at 3 per cent. on 19th–22nd August and 2nd–20th October in dusts, and O,O-diethyl S-(isopropylcarbamyl)methyl phosphorodithioate at 0·06 per cent. in a spray on 17th August and 3 per cent. in a dust on 24th August. All treatments, except the single application of the last material in a dust, were found, at examination on 25th November, to have given complete kill of the larvae within the olives [*cf.* **45** 241]; ten living larvae were found among 80 from the olives dusted once with the last material, but it was not possible to determine when the treatment had lost its effectiveness. There were 75 living larvae among 88 from untreated olives.

Foschi (S.) & Carlotti (G.). *Malacocoris chlorizans* **Pz. var.** *smaragdina* **Fieb. predatore del ragno rosso.** [*M. chlorizans* var. *smaragdina* predacious on the Red Spider Mite.]—*Redia* **41** (1956) pp. 105–111, 3 figs., 5 refs. Florence [1957]. (With a Summary in English.)

Nymphs of *Malacocoris chlorizans* (Panz.) var. *smaragdina* Fieb. were observed preying on the eggs of *Metatetranychus ulmi* (Koch) on apple and other fruit trees in Emilia in 1951–52. The various stages of this Mirid are briefly described, and observations on its bionomics [*cf. R.A.E.*, A **42** 63] made in the field and laboratory in 1952–53 are recorded. It was found that

the eggs overwintered and that hatching began in early May, about a month later than the hatching date for *M. ulmi*. Adults appeared in the first ten days of June, and summer eggs were observed on 7th–8th July. These were laid singly on the leaves and hatched in about ten days. Adults were again present from 8th–10th August, and winter eggs were laid between about 10th September and 10th October. The adults, which are very mobile, were not observed feeding, and the nymphs attacked only the eggs of the mite. The effect of acaricides on the Mirid was studied in an apple orchard in which various treatments had been applied against *M. ulmi*. Winter sprays of lime-sulphur, alone or with tar distillate, and products containing dinoseb were not injurious to the eggs, but oil emulsions, alone or with DNC, killed 85–90 per cent. of them. In summer sprays, Aramite (2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite) and Ovotran (p-chlorophenyl p-chlorobenzenesulphonate) did not harm the eggs or nymphs, and schradan did not affect the nymphs, but oil emulsions, DDT and parathion were highly toxic to the nymphs and the oils killed 100 per cent. of the eggs.

Zocchi (R.). **Insetti del cipresso. I. Il gen. *Phloeosinus* Chap. (Coleoptera Scolytidae) in Italia.** [Insects on Cypress. I. The Genus *Phloeosinus* in Italy.]—*Redia* **41** (1956) pp. 129–225, 1 pl., 45 figs., 3 fldg. tables, 9 pp. refs. Florence [1957]. (With a Summary in English.)

In this paper, which is the first of a proposed series on the arthropods that infest cypress (*Cupressus*) in Italy, the author reviews from the literature and his own observations in Tuscany the species concerned and discusses in detail the two most injurious. These are the bark-beetles, *Phloeosinus aubei* (Perris) and *P. thujae* Perris, which occur throughout Italy. Lists are given of the known species of *Phloeosinus*, showing the country or region typical for each, and the 11 palaearctic species, showing their distribution and food-plants.

All stages of *P. aubei*, which is the more important, are described in detail. It has been recorded as *P.* (*Hylesinus*) *bicolor* (Brullé) [*cf. R.A.E.*, A **27** 225], but the author concludes, from a review of the literature, that *H. bicolor* is a synonym of *H. oleiperda* (F.); *P. hercegovinensis* Egg. [**11** 26] is a synonym of *P. aubei*. The adults left the trees in which they had overwintered, when the daily temperature reached about 10–14°C. [50–57·2°F.], in March–April, flying in groups of some hundreds to fresh trees. These were mostly 15–20 years old, and trees already weakened were preferred. Both sexes took part in the construction of the maternal galleries, which were mostly formed in the lower parts of the trunks and are described and figured, and the eggs were laid in cells along them. The larvae hatched in about ten days, tunnelled irregularly beneath the bark and pupated after about 1·5–2 months in cells in the galleries. The pupal stage lasted about ten days. Adults were observed in the field towards the end of July, when they migrated to young trees and fed in the axils or, more usually, mined in the pith of the current year's shoots. On reaching sexual maturity, they moved to older cypresses and gave rise to a second generation, the adults of which emerged in September and overwintered in the galleries excavated for maturation feeding.

The natural enemies of *P. aubei* are reviewed from the literature. Those observed by the author comprised the predators, *Thanasimus formicarius* (L.), *Crematogaster scutellaris* (Ol.), *Pheidole pallidula* (Nyl.), and *Laemophloeus juniperi* Grouv., which was rare, and the parasites, *Metacolus unifasciatus* Thoms., and *Eurytoma morio* Boh., which attacked the larvae. Young trees in nurseries can be protected from damage by spraying or dusting with

DDT or other contact insecticides, and an existing infestation can be checked by removing the bark before the adults emerge.

Descriptions are given of the adults of both sexes of *Phloeosinus thujae*, of which *P. serrifer* Wichm. [**5** 95] and *P. prostratus* Peyer. [**27** 226] are synonyms. The larvae overwintered in their galleries and pupated in spring, and the adults emerged after about a fortnight, in the first half of June or later, at temperatures of about 23°C. [73·4°F.]. A period of maturation feeding was necessary, but young growth was not essential for this. The eggs were laid in cells along the maternal galleries, and the larvae, which hatched in about ten days, mined beneath the bark in the same direction as the latter and pupated in the following spring. The natural enemies of *P. thujae* are reviewed; the only one observed by the author was *L. juniperi*.

Descriptions are also given of the adults of both sexes of *P. stoeckleini* Schedl and *P. rudis* Bldf., which occur in Yugoslavia and southern France, respectively, and might spread to Italy. The former attacks cypress, and the latter trees of related genera. The characters of the adults of all four species are compared in a table.

Fenili (G. A.). **Contributo alla conoscenza morfo-biologica della** *Dicranura vinula* **L. (Lepidoptera-Notodontidae).** [A Contribution to Knowledge of the Morphology and Bionomics of *D. vinula*.]—*Redia* **41** (1956) pp. 343–510, 81 figs., 7½ pp. refs. Florence [1957]. (With a Summary in English.)

The following is based on the author's summary. Detailed descriptions are given of all stages of *Dicranura vinula* (L.), together with information on its bionomics on poplar and willow in Tuscany based on investigations in 1952–55, the results of which are compared with those recorded from southern Italy, and on its distribution, food-plants and natural enemies. In Tuscany, there was one generation a year and the pupae overwintered. The adults emerged between late March and late April, and the eggs were laid singly on the upper surfaces of the leaves or on new shoots, the numbers per female averaging 180. The larvae hatched in 2–12 days, fed on the leaves, and pupated in May–June. The Encyrtid, *Ooencyrtus vinulae* (Masi), was found parasitising the eggs.

Brimblecombe (A. R.). **Pineapple Scale Investigations.**—*Qd J. agric. Sci.* **12** no. 3 pp. 81–94, 13 figs., 4 refs.; also as *Bull. Div. Pl. Ind. Dep. Agric. Qd* no. 83, 14 pp., 13 figs., 4 refs. Brisbane, 1955.

Diaspis bromeliae (Kerner) persisted for several years at low levels on pineapple in the district in Queensland in which heavy infestation occurred in 1942 [*cf. R.A.E.*, A **33** 248], but increased in the second half of 1948, when it spread to other plantations and districts, in some cases by the distribution of planting material. Both rough- and smooth-leaved varieties were attacked, and the Coccid was also observed on *Billbergia* spp. in parks in Brisbane. In the second half of 1949, numbers began to decline, largely owing to natural enemies. The most important of these were *Aphytis* sp., which parasitised 8·4–25·2 per cent. of the total population between June 1949 and July 1950, and Coccinellids of the genera *Rhizobius* and *Orcus*, which became numerous in November 1949 and subsequently destroyed averages of about 22 per cent. of the Coccids, particularly those on the leaf blades. Between May 1950 and November 1951, the percentage of females of *D. bromeliae* found living, with or without eggs, was usually low and

exceeded 50 in only five months; it reached a peak in summer and a secondary one in early winter. The percentage that produced eggs exceeded 20 in each month except January. By November 1951, populations were so low that counts were discontinued. It is concluded that the Coccid is not of major importance, but that it might become so if it spread to the main pineapple-growing districts.

In work on control, the value of a spray of oil emulsion and nicotine sulphate in general use was investigated, and no consistent benefit was obtained from thorough applications of 16 parts white oil (80 per cent. mineral oil) and one part nicotine sulphate in 640 parts water at 150 gals. per acre in June and December 1949 and March 1950. The Coccids were most numerous on the upper surfaces of the leaf bases, and mortality was rather higher there than on the leaf blades. In a comparative test with other insecticides, the results of which were complicated by a natural decline in infestation, only parathion was considered to show promise, but when this was applied once or twice, with an interval of two weeks, at a concentration of 0·025 per cent. in June and December at 250 and 180 gals. per acre on thinned and unthinned plants, respectively, it gave no immediate benefit, and infestation was subsequently too low for conclusive results. None of the insecticides affected flowering, but, in a test in 1952, a dust and various sprays of BHC applied five weeks or more before harvest caused tainting.

Gay (F. J.), Greaves (T.), Holdaway (F. G.) & Wetherly (A. H.). **Standard Laboratory Colonies of Termites for evaluating the Resistance of Timber, Timber Preservatives, and other Materials to Termite Attack.** —*Bull. sci. industr. Res. Org. Aust.* no. 277, 60 pp., 4 pls., 7 figs., 16 refs. Melbourne, 1955.

The following is based largely on the authors' summary. An account is given of the techniques developed at Canberra for maintaining termites in the laboratory and for evaluating the susceptibility of timbers to attack by them and the effectiveness of protective treatments. The work has been in progress for over 20 years [*cf. R.A.E.*, A **19** 234]. The method of establishing standard colonies, which is described in detail, was developed for *Nasutitermes exitiosus* (Hill) and later modified for use with *Coptotermes lacteus* (Frogg.) and *C. acinaciformis* (Frogg.). Each of these species forms large mound-dwelling colonies in the field, from which adequate supplies of experimental material can be obtained, and a method is described by which over a quarter of a million clean, undamaged termites can be separated from the mound material within a few hours. Colonies of *N. exitiosus* that proved to be satisfactory test units were standardised with respect to the container, matrix (which consisted of actual nest material), moisture content, ventilation and initial population, and were maintained at a constant temperature of 26°C. [78·8°F.] and a relative humidity of 75 per cent. throughout the standard test period of 12 weeks. Control colonies were provided with starch-free wood of *Eucalyptus regnans* as food, and could be maintained in the laboratory for over 18 months under these conditions. Only the initial water content of the matrix material needed to be modified for the other two species. Preliminary tests with *Mastotermes darwiniensis* Frogg. showed that this termite also can be maintained in the laboratory, but it is more difficult to handle than the others, and satisfactory standard conditions had not been developed at the time of writing.

The relative susceptibility of timbers was assessed by a rating system in early tests with non-standardised colonies of *N. exitiosus*, in which timber samples of several species were exposed simultaneously in one colony, and the order of susceptibility obtained was largely confirmed in similar tests

with standardised colonies. Later, however, each timber was tested separately and the results assessed by the loss in weight of the sample and by the survival period of the colony or the population level at which it persisted. When standard colonies of *N. exitiosus* were used to determine the relative protection given to samples of starch-free timber of *E. regnans* by impregnation with solutions of arsenic trioxide and arsenic pentoxide at concentrations of 0·001–0·035 per cent. by weight, little difference was found in the toxicity to the workers or the amount of wood consumed at the highest concentration, but at 0·017, 0·008 and 0·004 per cent., the trioxide was considerably more toxic and gave considerably more protection than the pentoxide, and at 0·008 per cent. its toxic action was more than twice as rapid. At a concentration of 0·004 per cent., either material permitted the colonies to survive the test period, but more termites died in colonies exposed to wood impregnated with the trioxide. Concentrations of 0·002 per cent. gave virtually no protection. Comparative tests of matched timber specimens, cut from the same boards and resembling each other as much as possible in grain and position in the tree, exposed in standard laboratory colonies of *N. exitiosus*, *C. lacteus* and *C. acinaciformis* showed that the food preferences and rates of attacks of the three species differed, so that the results obtained for one may not apply to the others.

MARTYN (E. J.). **Further Experiments on the Control of the Pasture Cockchafer, *Aphodius pseudotasmaniae* Given, in Tasmania.**—*Tasm. J. Agric.* **27** no. 1 pp. 44–49, 1 graph, 7 refs. Hobart, 1956.

Observations were continued in 1952 on the numbers of larvae of *Aphodius pseudotasmaniae* Given and the two most prevalent species of Melolonthids in pasture in Tasmania that had been treated 30 months earlier with DDT at 4, 16 and 32 oz. per acre in superphosphate [*cf. R.A.E.*, A **40** 161]. Numbers of all three were significantly lower in the plot treated at the highest rate than in the controls, but the two lower rates were no longer effective against *Aphodius* and one of the Melolonthids. In 1953, populations were low in all plots, and no sampling was carried out. In a discussion of the results, which were in general agreement with those obtained by Carne [**42** 47], the unexpected reduction in Melolonthid larvae in the second season is stated to be due almost certainly to the fact that many were then in the first or second instars, which are the most susceptible; heavy mortality of third-instar larvae of one species caused by the highest concentration in the second season but not the first, is attributed to delayed leaching of the DDT into the lower layers of soil [*cf.* **42** 47].

In 1953, sprays were tested against *A. pseudotasmaniae*. Aldrin was applied at 8 and 16 oz. and γ BHC (as lindane) at 2 and 4 oz. in 100 gals. spray per acre on 11th–12th August. Sampling on 29th September and 1st October showed that all four treatments gave significant control, though γ BHC was slightly superior to aldrin. In a further test in 1954, the γ BHC sprays and sprays of commercial BHC and aldrin at 4 and 6·6 oz. per acre, respectively, were compared with granules containing 2·5 per cent. aldrin on tobacco waste at 30 lb. per acre in treatments applied on 16th June. By 7th–8th September, all treatments had caused significant reductions in population, γ BHC at 2 and aldrin at 6·6 oz. being the least effective.

In view of the sporadic occurrence of damage by *Aphodius* in Tasmania, treatment with preventive dressings of DDT or γ BHC in superphosphate should be limited chiefly to slopes too steep for spray equipment. Low-volume emulsion sprays affording 4 oz. γ BHC per acre are recommended against established infestations, as no fully suitable equipment is available for the widespread application of granules.

Wright (D. W.) & Buxton (J. S.). **The Control of the Cabbage Stem Weevil in *Brassica* Seed-beds.**—*7th Rep. nat. Veg. Res. Sta. 1955–56* pp. 57–59, 2 refs. Wellesbourne, 1957.

In England, *Ceutorhynchus quadridens* (Panz.) attacks spring-sown cruciferous vegetables, particularly in seed-beds, the eggs being laid in the stems and petioles and the larvae mining in the stems and pupating in the soil; up to 14 larvae have been found in the hollowed stalk of a single seedling. Infested plants are stunted or even killed, or the stems may snap during transplanting. In 1955, a suspension of 0·02 per cent. γ BHC (lindane), applied in a band along the row when the seedlings had 2–3 true leaves, resulted in 98 per cent. uninfested plants of summer cabbage, and seed treatment with 1 oz. 75 per cent. γ BHC per lb. seed resulted in 76 per cent. uninfested plants and only slight damage to the remainder, whereas only 7·5 per cent. of untreated plants escaped attack. Treatment of the seedlings with aldrin dust and aldrin and dieldrin suspensions was comparatively ineffective.

In 1956, the two γ BHC treatments resulted in 94·7–95·3 per cent. freedom from infestation in cabbages sown in early April and examined in early June, when the plants were removed for transplanting, whereas dieldrin and endrin seed dressings and aldrin and dieldrin suspensions applied along the rows gave little or no control. Plants treated with γ BHC or dieldrin or given no treatment were kept under observation after transplanting, and the first were almost twice as large after a month as the untreated plants and those receiving dieldrin as a seed treatment, matured earlier and gave much heavier yields. Although band treatment with dieldrin suspension gave only partial control of *C. quadridens* in the seed-bed, it resulted in crops comparable with those from the γ BHC treatments in earliness and yield, since it also gave some control of the cabbage root fly [*Hylemyia brassicae* (Bch.)], which attacked the plants in the field, whereas the other treatments did not. Seed treatment with γ BHC is preferred to the band treatment, as it is easier and cheaper to apply and also protects the seedlings against *H. brassicae* and *Phyllotreta*.

Papers noticed by Title only.

Terényi (S.) & Bognár (S.). **Die Rübenmotte und die Ergebnisse ihrer Bekämpfung in Ungarn in den Jahren 1950–1953.** [The Beet Moth (*Gnorimoschema ocellatella*) and the Results of Experiments carried out in Hungary in 1950–53 for its Control.]—*Acta agron. Acad. sci. hung.* **6** no. 3–4 pp. 411–441, 10 figs., 30 refs. Budapest, 1956. (With Summaries in Russian and English.) [German translation: *cf. R.A.E.*, A **45** 205.]

Costantino (G.). **La lotta contro le cocciniglie degli agrumi mediante emulsioni di olii minerali e di esteri fosforici, da sole o in miscela.** [The Control of Coccids on *Citrus* in Italy with Emulsions of mineral Oil and phosphoric Esters, alone or in Mixtures.]—*Ann. Sper. agr.* (N.S.) **11** no. 3 suppl. pp. cxxi–clvii, 1 fldg. table, 60 refs. Rome, 1957. (With a Summary in English.) [See *R.A.E.*, A **45** 298.]

Russo (G.). **Stato attuale della lotta contro la mosca delle olive** (*Dacus oleae* **Gml.**). [The present Position in the Control of *D. oleae* on Olive in Italy.]—*Ann. Sper. agr.* (N.S.) **11** no. 3 suppl. pp. ccxxvii–ccli, 15 refs. Rome, 1957. (With a Summary in English.) [See *R.A.E.*, A **45** 133.]

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INDEX OF AUTHORS

ANON, 445.
Abbott, H. G., 434.
Aziz, S. A., 419.

Badgley, M. E., 429.
Bailey, S. W., 417.
Bald, J. G., 425.
Ball, H. J., 440.
Baptist, B. A., 415, 416.
Becker, W. B., 434.
Bissell, T. L., 431.
Bognár, S., 452.
Bogush, P. P., 423.
Brimblecombe, A. R., 449.
Brookes, R. F., 421.
Brown, A. W. A., 435.
Brown, B. E., 435.
Brown, H. E., 443.
Brunner, Yu. N., 422.
Burke, H. B., 436.
Buxton, J. S., 452.

Carlotti, G., 447.
Carlson, E. C., 435.
Chamberlain, W. F., 434, 437.
Chapman, A. J., 443.
Chatters, R. M., 426.
Clark, E. C., 433, 438.
Close, D. H., 425.
Collins, W. E., 427.
Costantino, G., 452.
Cowan, jr., C. B., 439.

Dahm, P. A., 425.
Daniels, N. E., 426.
Davis, J. W., 439.
De Silva, M. D., 417.
Diehl, S. G., 426.
di Martino, E., 413.
Ditman, L. P., 431.
Dogger, J. R., 430.

Fenili, G. A., 449.
Fleschner, C. A., 429.
Foschi, S., 447.

Gaines, R. C., 441
Gay, F. J., 450.
George, K. S., 420.
Gerasimov, A. M., 424
Gojmerac, W. L., 440.
Gooden, E. L., 440.
Greaves, T., 450.
Grosch, D. S., 430.
Guthrie, F. E., 427.

Hall, J. C., 429.
Hanson, W. D., 428.
Hill, A. R., 417.
Holdaway, F. G., 450.
Hopkins, A. R., 436.
Hudon, M., 446.

Jefferson, R. N., 425.
Johansen, C., 432.
Johnson, W. T., 442.
Jourdan, M. L., 444.

Khadzhibelli, Z. K., 422.
Klostermeyer, E. C., 438.
Kono, T., 415.
Kreitsberg, V. E., 424.

Lindquist, D. A., 425.

McCabe, J. B., 417.
Mal'kovskiĭ, M. P., 422.
Marshall, J., 445.
Martin, D. F., 436.
Martyn, E. J., 451.
Mason, H. C., 439.
Melis, A., 446, 447.
Middlekauff, W. W., 437.
Moiseev, A. E., 423.
Monro, H. A. U., 446.

Morgan, C. V. G., 445.
Morishita, F. S., 425.

Newton, R. C., 429.

Parencia jr., C. R., 439.
Pfrimmer, T. R., 441.
Porter, K. B., 426.

Rabb, R. L., 427.
Ranaweera, D. J. W., 415.
Rasmussen, W., 438.
Reiner, C. E., 433, 438.
Rich, J. H., 434.
Richardson, H. H., 442.
Ricker, D. W., 429.
Ringel, S. J., 440.
Roth, H., 442.
Russo, G., 452.

Sankaran, T., 414.
Shapiro, I. D., 424.
Shiller, I., 443.
Solomon, M. E., 419.
Stuart, A. M., 418.

Terényi, S., 452.
Turner jr., E. C., 432.

Upitis, E., 446.

Van Middelem, C. H., 427, 428.

Walker, R. L., 436.
Wene, G. P., 441.
Wetherly, A. H., 450.
Wilson, J. W., 428.
Woodside, A. M., 432.
Wright, D. W., 452.
Wylie, W. D., 431.

Zocchi, R., 413, 448.

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CONTENTS.

PAGE

AFRICA, NORTH: Cereal Bugs in Morocco 444
AUSTRALIA: *Diaspis bromeliae* on Pineapple and its Control 449
AUSTRALIA: The Rearing of Termites for Use in Tests 450
AUSTRALIA: Insecticides against *Aphodius pseudotasmaniae* in Pasture in Tasmania 451
BRITAIN: The reproductive Behaviour of *Amphorophora rubi* on Raspberries 417
BRITAIN: The natural Enemies of *Brevicoryne brassicae* 420
BRITAIN: Insecticides against *Ceutorhynchus quadridens* on Cabbage ... 452
CANADA: Pests in an unsprayed Orchard in British Columbia 445
CANADA: A first Record of *Dibrachys cavus* from *Pyrausta nubilalis* ... 446
CEYLON: *Brevipalpus* spp. on Tea and their Control 415
CEYLON: Insecticides affecting Parasitism of *Homona coffearia* 416
CEYLON: The Species of *Helopeltis* on Cacao 417
COSTA RICA: The Distribution of *Ceratitis capitata* 445
CUBA: A Virus Disease of Rice 445
HUNGARY: Control of *Gnorimoschema ocellatella* on Beet (*Title only*) ... 452
INDIA: The natural Enemies of *Ceroplastes pseudoceriferus* 414

[*Continued on p. iv of cover*

CONTENTS—*cont.*

PAGE

ITALY: Experiments against *Rhagoletis cerasi* and *Ceratitis capitata* ... 413
ITALY: Winter and Spring Emergence of *Dacus oleae* 446
ITALY: New Insecticides against *Dacus oleae* 447
ITALY: *Malacocoris chlorizans* destroying Eggs of *Metatetranychus ulmi* ... 447
ITALY: Two species of *Phloeosinus* infesting Cypress 448
ITALY: The Bionomics of *Dicranura vinula* 449
ITALY: The Control of Coccids on *Citrus* (*Title only*) 452
ITALY: The Control of *Dacus oleae* (*Title only*) 452
NEPAL: Strains of *Calandra oryzae* 415
NEW ZEALAND: *Ephialtes brevicornis* parasitising *Plutella maculipennis* ... 418
SICILY: *Otiorhynchus cribricollis* attacking *Citrus* and its Control 413
U.S.S.R.: A Eumastacid damaging Bush Fruits and Strawberry in Alma-Ata 422
U.S.S.R.: Coccids injurious to Oak in Georgia 422
U.S.S.R.: *Cleonus brevirostris* on Beet in Samarkand 422
U.S.S.R.: A Flea-beetle injurious to *Agropyrum* spp. 423
U.S.S.R.: The Spring Development of *Heliothis armigera* in Turkmenia ... 423
U.S.S.R.: A Species of *Recurvaria* infesting Pistachio Fruits 424
U.S.S.R.: Unusual Insect Damage to Cereals near Leningrad in 1952 ... 424
U.S.A.: Soil Fumigation against Pests and Diseases of Gladiolus 425
U.S.A.: Crop Sequence and Damage to Wheat by *Toxoptera graminum* ... 426
U.S.A.: Control of *Myzus persicae* on Tobacco 427
U.S.A.: The Control of *Drosophila* on Tomatos for Processing ... 427, 439
U.S.A.: *Tachysphex* spp. preying on a Grasshopper 429
U.S.A.: The Air Drift of Tetranychid Mites 429
U.S.A.: Granular Insecticides against Thrips on Groundnuts 430
U.S.A.: Spray Treatments against Insects on Lucerne 431
U.S.A.: *Drosophila* and Bioassay of Insecticide Residues in Soil 431
U.S.A.: The Control of *Hylastes obscurus* on Clover 432
U.S.A.: The Use of a Polyhedrosis Virus against *Malacosoma fragile* ... 433
U.S.A.: BHC protecting Pine Logs from Beetle Attack 434
U.S.A.: *Lygus hesperus* injuring Carrot Seed and its Control 435
U.S.A.: Granular Insecticides controlling hibernating Adults of *Anthonomus grandis* 436
U.S.A.: Chrysopid Predators of *Aphis gossypii* on Cotton 436
U.S.A.: A Sawfly feeding on Honeysuckle 437
U.S.A.: Adjuvants for Sprays containing a Polyhedrosis Virus 438
U.S.A.: Tests of Insecticides against Cotton Pests 436, 439, 441, 443
U.S.A.: Soil Treatments against *Diabrotica* on Maize 440
U.S.A.: Effects of Soil Insecticides on Germination of Sugar-beet ... 440
U.S.A.: *Tetranychus marianae* infesting Tomato 441
U.S.A.: Ethylene-dibromide Fumigation of Mangos at low Temperatures 442
U.S.A.: Leaf-feeding Pests of Chestnut in Maryland 442
U.S.A.: Systemic Insecticides against *Mayetiola destructor* 443
A Controller for a Light Source 417
Estimation of relative Humidity with Cobalt Thiocyanate Papers 419
The Reactions of *Schistocerca gregaria* to physical Factors 419
Toxicity of organic Sulphides to Eggs of *Tetranychus telarius* 421
Metabolism by Insects of radioactive DDT 425
The Mechanism of Feeding of *Myzocallis maculata* 426
Factors affecting Residue Determinations on Cabbage and Celery 428
Irradiation inducing Lethargy in Insects 430
Chemical Structure and insecticidal Activity of systemic Insecticides ... 432
An Olfactometer for Use with agriculturally important Insects 434
Effects of Insecticides on Cytochrome Oxidase in *Periplaneta americana* ... 435
An improved Ethyl-acetate Jar for Light-traps 437
A Counting Plate for sampling Mite Populations 438
Effects of Storage Temperature on Water-dispersible Insecticide Powders ... 440
Calandra granaria and Resistance to Methyl Bromide 446

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